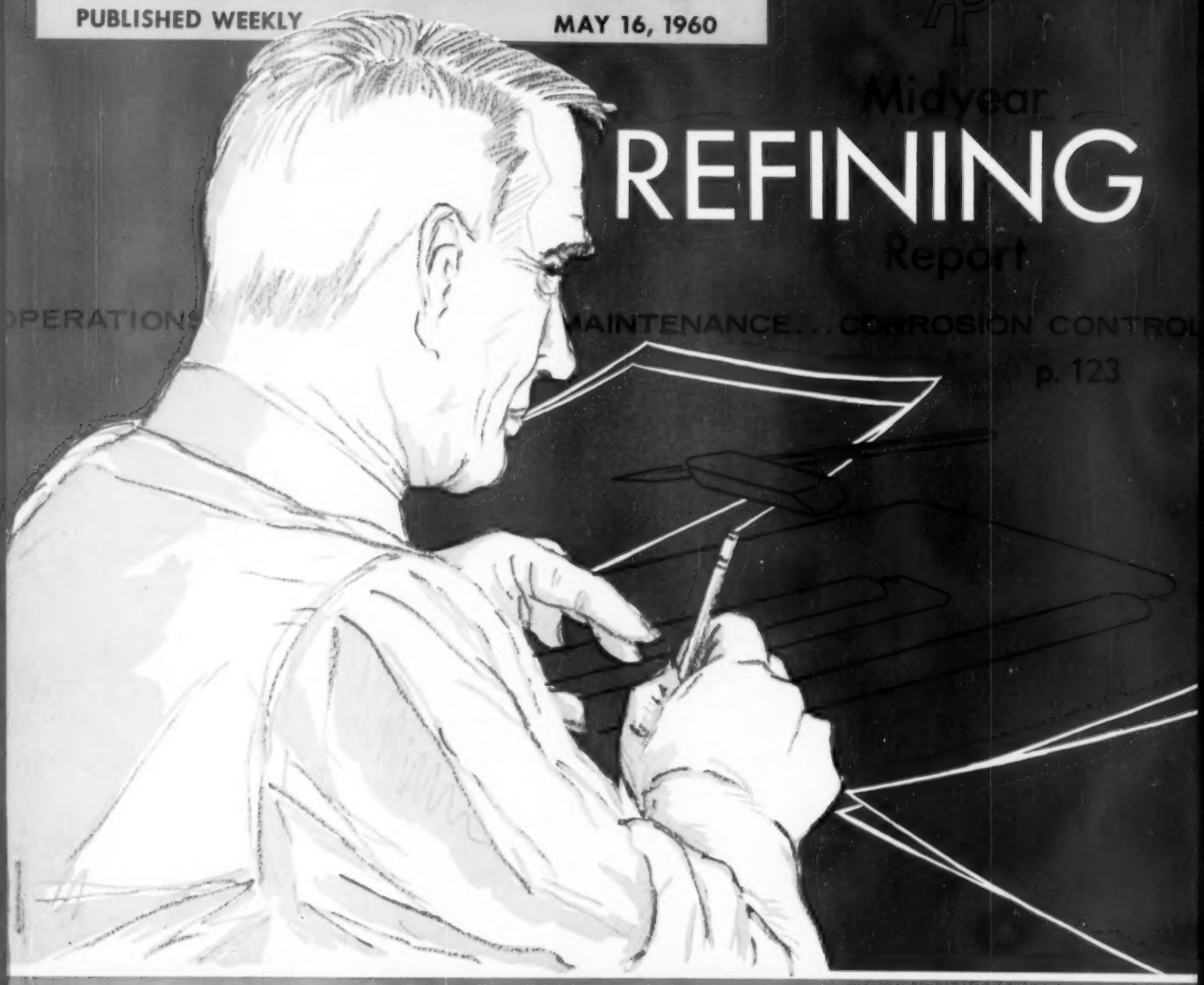
the OIL AND GAS JOURNAL

PUBLISHED WEEKLY MAY 16, 1960

Midyear REFINING Report



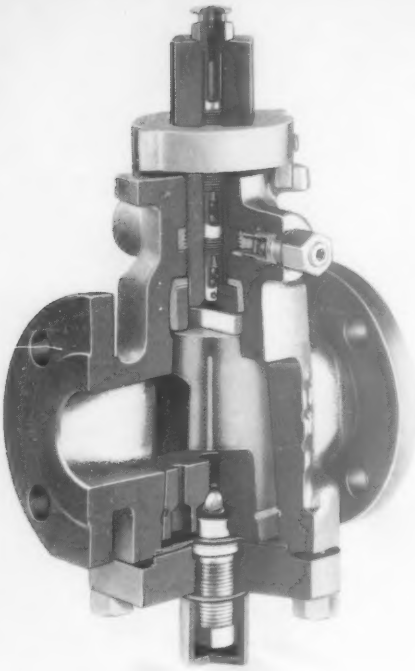
...PERATIONS ...MAINTENANCE... CORROSION CONTROL

p. 123

Producers make pitch for imports cut ▸ 91

Tank trucks take products direct from pipeline ▸ 102

Sealed-bearing bits mean longer runs ▸ 184



Rockwell-Nordstrom Hypreseal lubricated plug valve for higher pressure services. Shuts off positively, operates easily, can be repacked in service.

LEADERSHIP INVITES IMITATION

Rockwell Hypreseal valves will be copied, someday. Why? Because so many valve buyers have proved to themselves that it's the *only* valve for higher pressures that they can rely on to shut off positively, operate easily. Pressurized lubricant sealing stops leakage without exposed metal-to-metal seats, and lubrication plus the absence of deep stuffing boxes assures easy operation at highest pressure differentials. And, the Hypreseal can be completely repacked in service without costly down-time.

Ever since Sven Nordstrom built the first lubricated plug valve in 1916, *every* lubricated plug valve innovation has come to users first in a Rockwell-Nordstrom valve. And the millions of these valves in service today are proving how this leadership and continuing research and development are translated in better flow control at far lower cost. Write for money-saving ideas on *the* complete line of Rockwell-Nordstrom lubricated plug valves. Rockwell Manufacturing Company, Dept. 92-E Pittsburgh 8, Pa. Canadian Valve Licensee: Peacock Brothers Limited. Rockwell International, S. A., Geneva, Switzerland.

Lubrication Makes The Difference

ROCKWELL-Nordstrom VALVES

another fine product by

ROCKWELL

Rockwell Hypreseal valves stay in service longer at lower cost on high pressure mud manifolds because there are no exposed seats to be cut or worn.

OIL AND GAS JOURNAL
Vol. 58, No. 20

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API REFINING REPORT

Statistics Help the Refinery-Inspection Program 123

By W. P. Shontz, W. W. McDaniel, and R. R. Decker

This technique is particularly rewarding in these areas: (1) measuring thickness of piping circuits, (2) determining thickness variability in new piping and steel plate, (3) making thickness readings on tanks and vessels, and (4) determining corrosion rates of furnace tubes.

Use Radiography for Inspection Without Shutdowns 128

By L. A. White and T. Arnesen

Advantages include: (1) reduced down time, (2) no need for removal of insulation or other covering, (3) can be used on hot uninsulated equipment, (4) does not require flange openings, (5) determines safe operability of equipment, and (6) can follow closely program of corrosion or erosion.

Plan for Maintenance on Distillation Units 131

By W. S. Bonnell and J. A. Burns

A review of startup-shutdown procedures will pay off in safety, continuity of operation, and cost reduction.

Probes Prove Talented Corrosion Sleuths 135

Electrical-resistance probes are now widely accepted in petroleum refineries for monitoring the corrosivities of streams; for helping to solve emergency corrosion problems; and for determining the optimum level of inhibitors, neutralizers, or chemical treatments for corrosion control.

Safe Ups and Downs for Refining Units 143

By A. H. Hayes and R. M. Melaven

Procedures which clearly point out hazards, equipment which is properly designed, and personnel who are well trained, insure safe shutdowns. Incorporate these ideas into written procedures for your unit.

Corrosion Inhibitors Find a Wide Application 161

An API survey shows that organic film-forming inhibitors are finding successful application in many refinery services. In general, temperatures above 400° F. and increasing concentrations of impurities in process streams reduce inhibitor effectiveness.

Towers Are Touchy 166

By R. W. Ballmer

Coming on and offstream with primary distillation equipment can spell trouble. Here's one company's experience with this problem and an outline of its procedure for startup of vacuum towers and shutdown of crude-oil towers.

Technology—Operation

Planned Mud Program Cuts Drilling Costs 172

By K. D. Tanner and George B. Gray

The drilling operator on the Texas Gulf Coast can now tailor his mud program to take advantage of new mud materials and to minimize well trouble.

New Treater Passes Venezuelan Field Test 181

By C. E. De Young

A new heater-treater design has proved successful in handling severe asphaltic oil-water emulsions in a series of field tests. Result is greater lease economy.

Sealed-Bearing Bits Mean Longer Runs 184

By Ed McGhee

Drillers in hard-rock country are getting longer runs out of bits which have seals on bearings to keep grease in and mud out. Bearing seals promise to make drilling cheaper in formations in which bearings ordinarily wear out faster than do bit teeth.

New Epoxy Patches Tanks Successfully 186

Avoid Shorts at Cased Pipeline Crossings 189

By Steve Owens

Alaska Gets Its First Crude Line 191

The OIL AND GAS JOURNAL Newsletter

Tulsa, Okla.
May 16, 1960

Is the piston-engine doomed by the gas turbine?

Engineers still don't agree, Detroit API meeting shows.

General Motors speaker says such a development is not likely. Reason: Turbine's poorer fuel economy and pickup make it a poor substitute for pistons.

Chrysler speaker is more optimistic on turbine. He predicts turbines may surpass piston engines in next 6 years from engineering and cost viewpoints. After 1966 he sees turbines as most versatile, economical, and potentially low-cost power plant for passenger cars.

Other Detroit notes:

A standard compression-ignition fuel for powering all Army combat vehicles may become the Army's major energy source in the next 10 years.

Use of this wide-cut fuel—a 50-50 mixture of gasoline and distillate fuel—will help stretch the distillate portion of the crude-oil barrel.

Gas chromatography is being applied to a new use in analyzing hydrocarbon mixtures. Shell now can get boiling-point data on distillates ranging from propane to more than 750° F.

Results agree well with those obtained by time-consuming precision distillation method. New approach gives better accounting of light and heavy ends, more data on minor components.

API Chairman M. J. Rathbone told Detroit meeting the biggest need of refiners is profits (p. 94).*

Two well-dveloped techniques for corrosion work are available to refinery inspection engineers.

They are:

...Statistical analysis which can be used to accurately estimate corrosion rates and equipment life (p. 123).

...Radiography which will indicate condition of equipment without forcing a shutdown (p. 128).

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*Refers to article in this issue giving more details. Where no page is given, the item is a Newsletter exclusive.

Other technical discussions at Detroit centered around maintenance and operating safety procedures (p. 131-169).

Producers push for import cut in Washington moves.

An appeal for a review of the level of imports was made to the President by IPAA. Spokesmen for other producer groups urged Interior Department to cut the flow of imported crude (p. 91).

Interior has proposed an adjustment, but it is not what these groups want. Suggested is a change in the sliding-scale percentages used to determine quotas. The general effect: To decrease slightly imports into Districts 1-4 and raise them in District 5 (p. 92).

Democrats may stall on the two new FPC appointments.

Speculation is that Senate Democrats may try to delay confirmation of President Eisenhower's nominees and thus leave the vacancies for the new president in January. This could be difficult to do since the candidates, Paul A. Sweeney and Thomas J. Donegan, are not controversial (p. 107).

▼ ▼ ▼

Changes in crude purchasing:

Flat Prices have been raised 15 cents by Pure Oil for crude in Cabin Creek and Kelly's Creek fields of West Virginia. New posting—$4.22 per barrel.

Purchaser proration has been lifted by Sinclair in Kansas, New Mexico, and the Denver-Julesburg basin. The company had restricted purchases to 80% of January runs in Kansas and New Mexico, and 60% in the basin.

▼ ▼ ▼

What's happened to the expected exploration boom in Canada's Arctic Islands?

Thirty-four companies have applied for permits but only three have put up the cash payment due by June 24. Industry officials say the confusing regulations which attempt to ensure Canadian participation are the cause.

A government official says hopefully that it is possible the companies are waiting to the last minute to tender the cash.

Late snow falls in Canada. So does drilling rate.

Current survey in Western Canada shows only 95 rigs working out of 312 available. Southern Alberta weather has been unseasonable. Recently approved gas export plans are expected to stimulate a better-than-average summer drilling rate.

First Devonian oil recovered in Arizona.
The honor goes to a Paradox basin well—Texaco's 1-Z Navajo in Apache County. On drill-stem test at 6,760 to 6,800 ft., it recovered 120 ft. of free oil. Recovery included 90 ft. of heavily oil and gas-cut mud and 3,000 ft. of gas.
The well is 81 miles southeast of Northwest Lisbon, the only completed Devonian producer in the basin.

▼ ▼ ▼

Kuwait's third oil field, Raudhatain, is producing.
Initial production is 100,0000 bbl. daily. Including the wells in this field, Kuwait has only about 300 producing wells. It is the fourth largest producing country in the world (p. 117).

It's here: An ultrasonic device to inspect steel pipe.
A laboratory version of the machine was unveiled at the distribution-transmission conference of the American Gas Association last week at New Orleans. A prototype to inspect full lengths of pipe at mill runs will be constructed within 6 months.

Polyisoprene production to take a bounce.
The oil-based synthetic rubber is almost as good and cheaper than natural. Shell Chemical, now building a 17,850 long tons-a-year plant at Torrance, Calif., will treble its planned production with a plant in the midwest. Two other companies are entering the field and three additional firms may also jump in (p. 99).

Another "poly" in the news. Humble has formally opened its polypropylene plant at Baytown. The unit has an initial capacity of 40 million pounds a year of the high-strength thermoplastic. Basic facilities are included for expansion to 100 million pounds a year (p. 98).

Late first-quarter earnings reports: Indiana Standard net was $31.6 million, off sharply from $44.6 million in the same period last year...Texas Pacific Coal & Oil net was $2.10 million compared with $2.02 million in 1959...Sunray Mid-Continent reported net of $9,440,000 a reduction from $9,711,000 earned in the first quarter of 1959.

Oil directors note: Directors' fees have shown a slight increase during past 2 years to keep pace with prices and wages, National Industrial Conference Board reports. Most common fee for a meeting is $100...Jersey Standard in future may take its stockholder meetings on tour. Plans for possible meetings in New York, Boston, Chicago, Cleveland, Houston, and San Francisco as well as New Jersey will be voted on by stockholders at May 25 meeting.

Market Memo

May 16, 1960

Vacation time is a call to the open road.

College campuses are crowded with new compacts—more intimate on the inside, more room outside for the old folks' cars.

Spring is in the air and summer gasoline demand has begun. It's a buyer's market.

Gulf Coast cargo gasoline prices are weak contraseasonally due to lack of buyer interest. Prices are listless at one-half to three-quarters off posted prices. A split T-2 of 92 RON and 98 RON is priced at five-eighths cent under respective grades. While 98 RON in full cargo lot can be bought at three-quarters cent off posted price for prompt lifting.

A firm posted gasoline price can't be found, even in the yellow pages.

The price trend of Gulf Coast No. 2 is up, spotwise, at one-quarter to three-eights cent under posted 8-cent price. East Coast contract buyers for the 1960-61 season are asking larger quantities of No. 2 than last year. That's a good sign for down-the-road No. 2 prices, and this demand is backed up by low East Coast-Gulf Coast inventories for May.

Gulf Coast demand for No. 6 fuel is good and prices firm at $2.10 a barrel for garden variety and $2.45 for maximum 1% sulfur. As steel-mill demand for low-sulfur fuel eased off, foreign demand developed. Several cargoes have moved in recent weeks at full posted price for foreign delivery.

Mississippi River gasoline markets are caught between an inactive Gulf Coast Market and a Group 3 market still in shock from a series of price breaks totaling 1 cent a gallon.

Prices for spot lifting from midriver points range from the Gulf Coast low to half a cent off. There's no buyer activity for No. 1 and No. 2.

Group 3 northern-shipment gasoline may have hit bottom at a 10½-cent posting for 91 RON. Spot prices are a quarter off to volume buyers and 10¼ cents to the trade.

Middle distillates are more profitably held than sold in the present market. Both sellers and buyers are awaiting a firmer price base for Group 3 products.

In Chicago gasoline discounts of a quarter cent off postings are prevalent, making 91-92 RON available at 10.75. To volume buyers a "little more consideration" might be shown on a spot basis.

Middle distillate in Chicago is easy for spot at a quarter off posted prices of 9.25 cents for No. 1 and 8.5 for No. 2

For spot prices, see page 240.

Good Wells Make Good News

A Report on "Other" Services Offered by Dowell

MAY 16, 1960

Many people tend to associate Dowell with fracturing and acidizing only. The fact is that Dowell offers many other products and services to help operators make wells worth more. Here are four recent examples of "other" Dowell services and products in use:

- **Titus County, East Texas** (Old Well) 2⅜-inch EUE tubing was used as casing in reworking this well. A squeeze job to close off a channel left 13⅜ feet of set cement in the pipe. Dowell was called to remove the cement. A special tool with a downward-pointing jet (like those used for Abrasijet*) was run on 1¼-inch EUE tubing. Acid was pumped through the tool at one bpm and 1800 psi as tubing was lowered. All cement was removed in one hour.

- **Rice County, Kansas** (Old Oil Well) This well was producing from an open hole section of the Arbuckle from 3210 to 3225 feet. Production had dropped to 6 bopd. Dowell treated with Paraffin Solvent and Freflo*. 10 gallons Dowell Paraffin Solvent was poured into annulus followed by 1000 gallons lease oil mixed with 10 gallons Freflo. The Paraffin Solvent was allowed to set on formation two hours before being displaced at 500 to 700 psi and 0.5 bpm. Well was shut in overnight. Three weeks after treatment, well produced 14 bopd; operator was pleased with results.

- **South Texas** (New Well) This operator was making a quadruple completion using four strings 2⅜-inch EUE tubing as casing in a 9⅞-inch open hole. Total depth was 8970. Dowell pumped cement down the two longer strings simultaneously. The shorter strings were blanked off. Two pump trucks were fed by a single paddle-blender to provide uniform slurry as well as identical starting and completion times for cement to both strings. Barrel meters were used to assure that cement left both strings at the same time. 1300 sacks cement with 12 per cent bentonite were used to make a 12.8-pound slurry. This is just one of several similar jobs cemented successfully without leaving cement in either casing string. Dowell is also cementing dual completions with a single new pumping unit that incorporates two pumps and a blender.

- **Eddy County, New Mexico** (New Oil Well) This well had been completed into the Premier sand through conventional perforations between 2862 and 2902 feet. Gas/oil ratio was 300,000/1. Dowell squeezed the perforations with Cealment* using latex-cement, reperforated with Abrasijet, and then fractured. Well is now producing top allowable with a gor of 578/1.

If your problem is well improvement, dial Dowell. Chances are that one of Dowell's many services and products can help you. If not, perhaps a Dowell engineer can offer a helpful suggestion. Dowell services and products are offered from more than 150 offices and stations in the United States, Canada, Venezuela and Argentina. Dowell, Tulsa 1, Oklahoma.

*DOWELL TRADEMARK

Services for the oil industry DOWELL

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* with 2½ inch tubing

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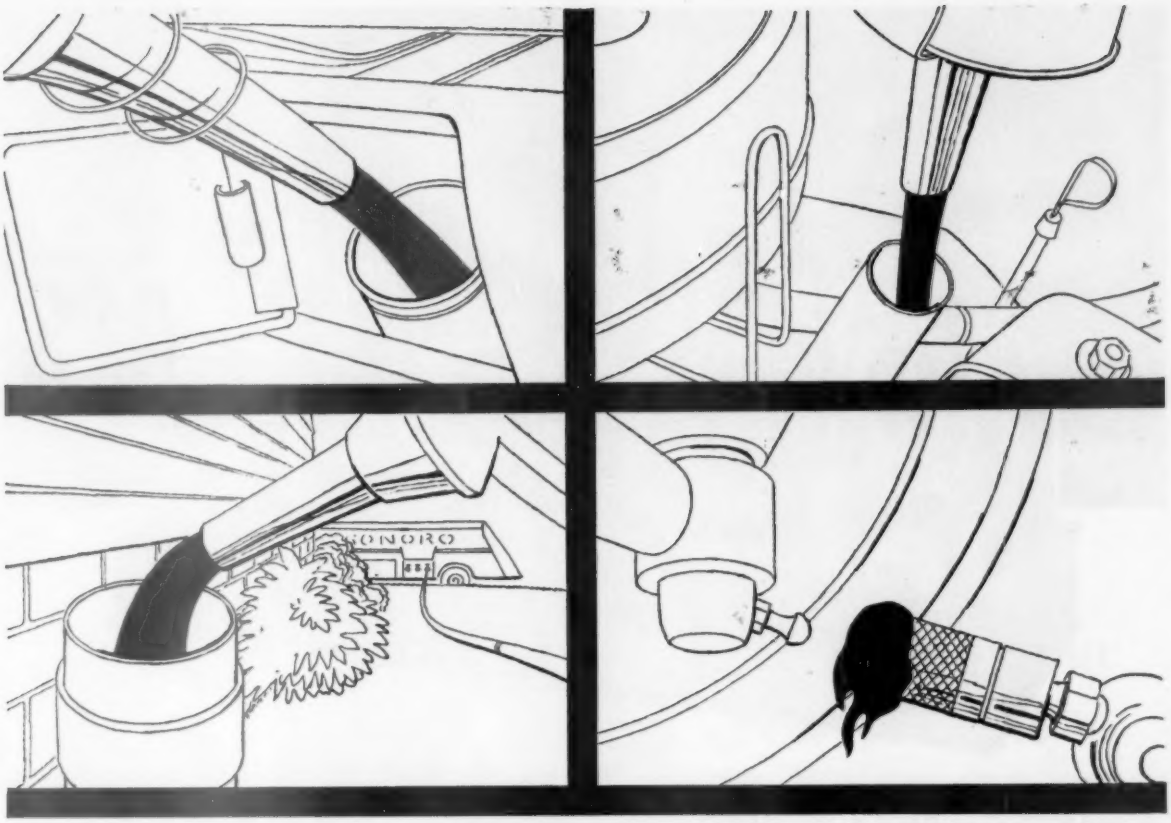

RAINBOW FOR SALE... with new finer-flaked Du Pont dyes

Du Pont petroleum dyes provide sales appeal for your products more efficiently than ever before

Because flaked dyes are virtually dust-free, they are constantly gaining in popularity. Today they're becoming the standard material for dyeing gasoline as well as adding sales appeal to other petroleum products—kerosine, home-heating oils, tractor and diesel fuels, lubricating oils and greases.

Now . . . faster dissolving. The new finer-flaked Du Pont dyes now dissolve more rapidly than ever. As a result, more and more refiners are finding they can take advantage of the dust-free properties of Du Pont flaked dyes.

Lower handling costs. The new flaked form of Du Pont petroleum dyes makes them free-flowing and easier to handle than powders. They are more compact, take up approximately half the space of conventional powdered dyes. Drum height has been reduced to 22 inches. This, too, makes handling easier and faster, as well as saving valuable storage space for the refiner.

Many colors. You can get these finer-flaked Du Pont dyes in orange, red and bronze. (Blue dye is available in a crystalline form which has the same advantages as flaked dyes.) Samples and full details are available from your Du Pont Petroleum Chemicals representative. Or write to E. I. du Pont de Nemours & Co. (Inc.), Petroleum Chemicals Division, Wilmington 98, Delaware.

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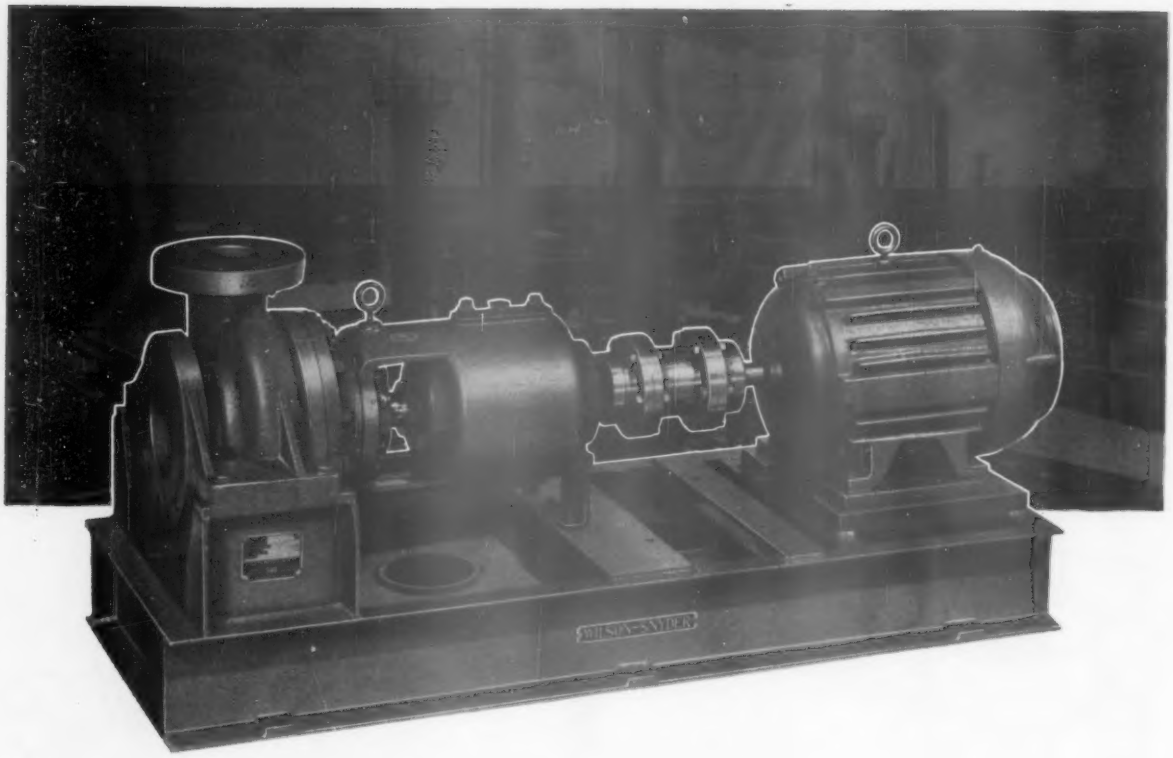

Wilson-Snyder announces a new line of heavy-duty Centrifugal Process Pumps—Type ESN

for maximum efficiency, dependability and economy

This all-new Wilson-Snyder Type ESN pump meets all and exceeds many of the requirements of A.P.I. Specifications and incorporates the following outstanding features:

- Double volute case design, for maximum radial balance at all load conditions in all sizes starting with 3" discharge and larger.
- Superior shaft design, with double row radial and double row angular contact type thrust bearings.
- Impeller designed for lowest possible NPSH without sacrifice of efficiency.
- Large effective cooling passages integral with stuffing box and bearing housing are designed for temperature applications up to 900 degrees F.

High-strength shaft design combined with double volute case design reduces shaft deflection to absolute minimum and allows widest possible range of operation. The double row ball radial and thrust bearings have been selected to assure long-life performance and lowest maintenance cost. Ring-oiled bearing lubrication with a large built-in oil reservoir provides positive and ample lubrication to all bearings. Stuffing boxes are designed for maximum packing standardization and all standard makes of mechanical seals can be applied interchangeably.

ESN pumps are available in a complete range of sizes, both single and 2-stage—end suction standard, top suction optional, on all single-stage pumps. Only five bearing bracket assemblies cover the complete line for horsepower applications up to 350. ESN pumps can be furnished in a wide range of metallurgy, including alloys suitable for highly corrosive and abrasive liquids.

Wilson-Snyder sales engineers

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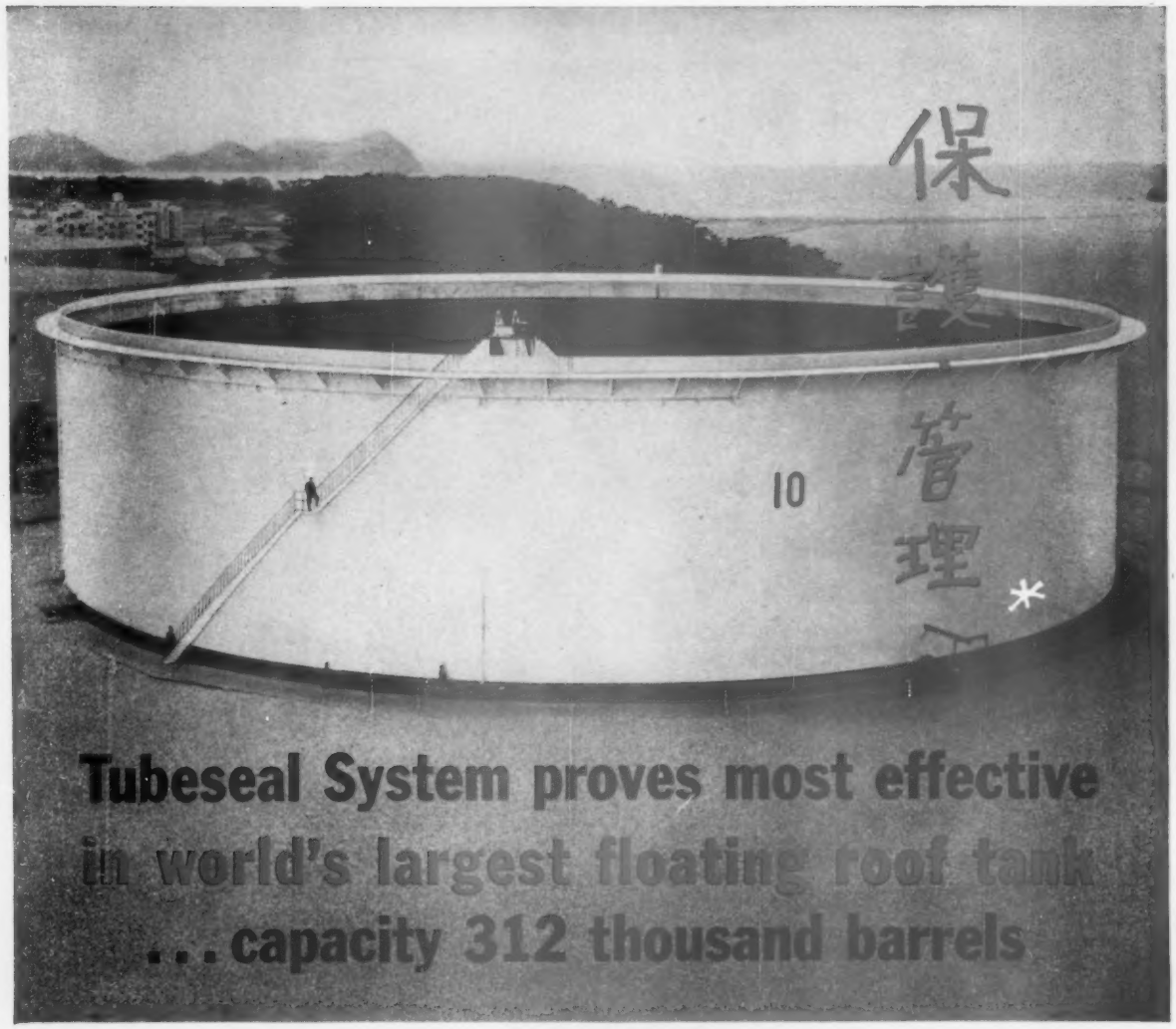

Tubeseal System proves most effective in world's largest floating roof tank . . . capacity 312 thousand barrels

Conservation is the same in any language . . . and in any country where petroleum or chemical products are stored, conservation can contribute substantially to profitable operations.

In Japan Toa Nenryo Kogyo K.K. installed the largest floating roof tank—210 feet in diameter, storage capacity 312,000 barrels. Significantly this tank is equipped with the renowned Hammond Tubeseal System‡. This is one of more than a hundred Hammond Tubeseal Systems operating in Japan. This Tubeseal floating roof tank, like the many hundreds operating everywhere throughout the free world, found wide and enthusiastic acceptance because of its effective protection against losses by evaporation, product contamination, corrosion, fire and explosion. Tubeseal Floating Roof Tanks are safety-vaults for storage of the volatile products of your refinery or petrochemical plant.

Write for bulletin which tells the entire story.

* *The above ideographs spell Conservation*

‡*Patented*

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Photographed at Gulf Refinery, Philadelphia, Pa.

How cooperation helped develop a new economy catalyst

Cooperation with refiners at all levels in helping them meet the demand for ever-improved fuels is a guiding principle by which Cyanamid works. This philosophy has aided in the development of many highly efficient catalysts, most recent of which is low-cost Aerocat® 2000 fluid silica alumina cracking catalyst.

Aerocat 2000, compared to natural MS catalysts, offers improved activity stability, higher octane production, superior attrition resistance, more uniform physical properties, and lower coke production.

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Basic in catalyst chemistry

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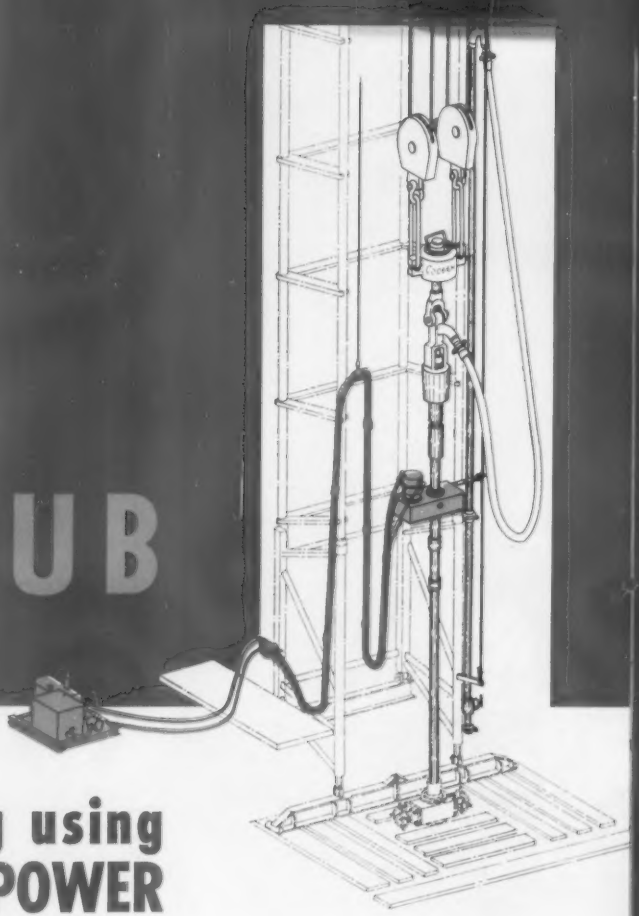
COOPER'S NEW
HYDRA-SUB



rotates the drill string using AVAILABLE HYDRAULIC POWER

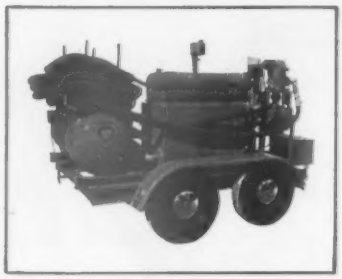
This new tool is designed for drilling and workovers. It is positioned on the drill string just under the swivel and on top of the drill pipe. As the hydraulic power is delivered through hoses the Hydra-Sub is free to move up and down in the derrick. This gives complete flexibility for fishing tool, workover or drilling operations. Rotation with the drill string is prevented by torque arms which travel on stabilizing lines in the derrick. Any standard swivel may be used.

HYDRA-SUB SAVES MORE THAN $2,000.00 OVER CONVENTIONAL ROTARY METHOD

A comparison of costs shows that the model 6030 rated at 30 H.P. which is suitable for most workovers and shallow or slim hole drilling, costs much less and has many advantages over older methods of rotating the drill string. The 6030 operates from most hydraulic systems on derricks or power tool systems.

NOW YOU DON'T NEED Rotary table, kelly, rotary drive sprockets and clutches — drive chains — chain guards or substructures to hold table.

YOU GET Fluid drive eliminating shock loads on drill string — reduces hazards and prolongs life of drill pipe. Accurate predetermined, torque control which protects threads, prevents twist-offs, makes possible continuous coring — has the flexibility for any job. Easily transferred from rig to rig.



Cooper trailer mounted Hydraulic Power Source and Model 6060 Hydra-Sub complete — ready for the road.

COOPER HYDRAULIC POWER SOURCE

Two sizes with hydraulic ratings of 30 H.P. and 60 H.P. Available with connections for other power tools—skid or trailer mounted — Trailer with hydraulic brakes and highway safety equipment — Powered by choice, gasoline, L. P. G. or diesel engines.

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FRED E. Cooper, Inc.

P. O. BOX 1890 TULSA, OKLA.

Branches: Houston, Odessa, Olney

ORIGINATOR OF MOBILE WINCH UNITS

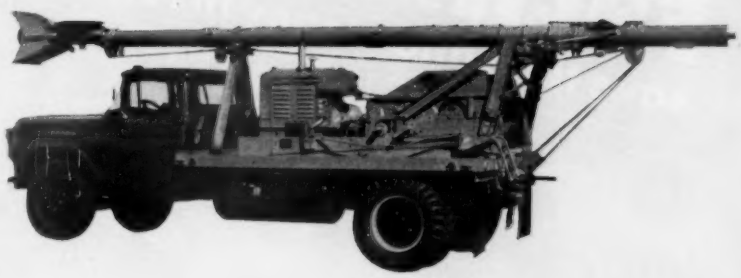
YES, COOPER STILL BUILDS THE MOST COMPLETE LINE OF WELL SERVICING AND WORKOVER RIGS...ENGINEERED

MODEL G-149 SKID WINCH FOR SERVICING TO 3000' OF 2" TUBING.

New field developed design is combined with high strength materials in a machine which can be transported over bad terrain with a small truck.

Sells at a price which makes it practical, for servicing marginal wells.

You don't pay extra for eight line speeds, vacuum actuated positive drum clutches, controls positioned at fingertips of operator, or sealed bearings at most points which eliminates lubricating them for their life, because all these features are standard.



FOR EVERY JOB . . . NO MATTER

MODEL G-226 SKID WINCH FOR SERVICING TO 4000' OF 2½" TUBING.

Weighs hundreds of pounds less, but has the power, brakes and line pull flexibility through the standard 8 speeds to give top performance for swabbing, bailing or pulling rods and tubing on wells which formerly required a heavy machine on a large cumbersome truck for transportation.

Simplified operation requires much less effort by the operator and crew to do the job.

WHAT THE SIZE . . . OR WHERE IT IS

MODEL P-32 SKID WINCH FOR SERVICING TO 6000' OF 2½" TUBING. POWERED BY GASOLINE, L.P.G. OR DIESEL ENGINES UP TO 150 H.P.

Another in the complete range of machines built by Cooper to fit the job without compromise in performance or unnecessary equipment cost.

Complete selection of auxiliary equipment engineered for the machine.

Available are: Pipe masts, derricks, rotary drives, spudding equipment, catheads, catline guides, dividers, line guide shells.

YOU'LL FIND THE BEST EQUIPMENT AT

OTHER COOPER WELL SERVICE MACHINES IN LARGER SIZES ARE BUILT WITH:

Hydraulic drives — air friction clutches — trailer mounted — self propelled and various designs for marine operations.

Tell us your needs — We have the right machine.

FRED E. Cooper, Inc.

P. O. BOX 1890 TULSA, OKLA.

Branches: Houston, Odessa, Olney

ORIGINATOR OF MOBILE WINCH UNITS

FALK and STEELFLEX are Registered Trademarks

Cut disconnect-reconnect time by as much as 50%

The FALK Spacer Coupling is specially designed for quick installation or removal *without disturbing the driving or driven unit.* This feature can save you up to 50% in disconnect-reconnect time when critical equipment—a process pump, for example—needs repair or replacement.

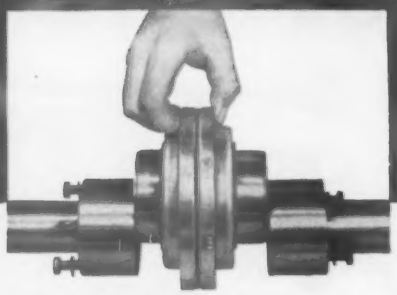
Here's another saving: with the FALK Spacer Coupling, you can quickly realign shafts *without the usual loss of operating temperature!*

And still another: you can remove or reinstall the FALK Spacer as a unit *without draining the lubricant.*

Because of its exclusive grid-groove Steelflex design, the FALK Spacer can accommodate residual misalignment—parallel, angular, or (most important) *both.* Also, it provides torsional resiliency that cushions shock and vibration. Thus it saves wear-and-tear on your connected equipment.

To prove these claims and enjoy these savings, install a FALK Spacer on one application—and see for yourself. Consult your FALK Representative or Authorized Distributor.

THE FALK CORPORATION, MILWAUKEE 1, WISCONSIN
MANUFACTURERS OF QUALITY GEAR DRIVES AND FLEXIBLE SHAFT COUPLINGS
Representatives and Distributors in many principal cities.

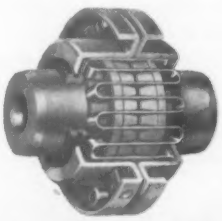


EASY AND QUICK TO INSTALL, DISCONNECT OR RECONNECT

First, mount shaft hubs to allow proper distance between hubs; then, align driving and driven units.

Second, compress Spacer to fit space between hubs and tighten cap screws to pull spacer hubs into the registered fit.

To disconnect, reverse the second step. No draining of lubricant necessary.



The heart of the FALK Spacer ...the basic Type F Steelflex
Write for Service Manual 4838

FALK
...a good name in industry

REGULATE LOSS RATES with *new* WAC-8

Here is Halliburton's *new approach* to fluid loss problems in fracturing with water or acid. WAC-8 is a Water/Acid Control additive which helps regulate wasteful fluid loss during fracture extension.

Add up these advantages of WAC-8:

LESS EXPENSIVE TO USE

- Low initial cost due to small quantity required.
- Not so much surface horsepower required since viscosity characteristics of WAC-8 actually helps lower friction loss down the hole.

MORE EFFICIENT AND EFFECTIVE

- Equally effective in fracturing with either water or acid.
- Greater fracturing extension by retaining more fluid *in the fracture.*
- Costly sand-outs reduced.

CLEANER FRACTURES

- Built-in breaker designed to leave flow channels cleaner.

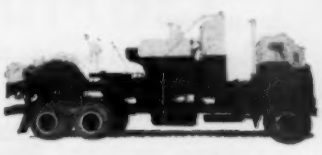
Ask your local Halliburton Representative about WAC-8 before programming your next fracturing job. He'll be glad to guide you in its use.

Visual and permanent records of your fracturing operation on-the-spot...the HALLIBURTON FRACOMETER! Ask about it

HALLIBURTON FRACTURING SERVICES

HALLIBURTON OIL WELL CEMENTING COMPANY

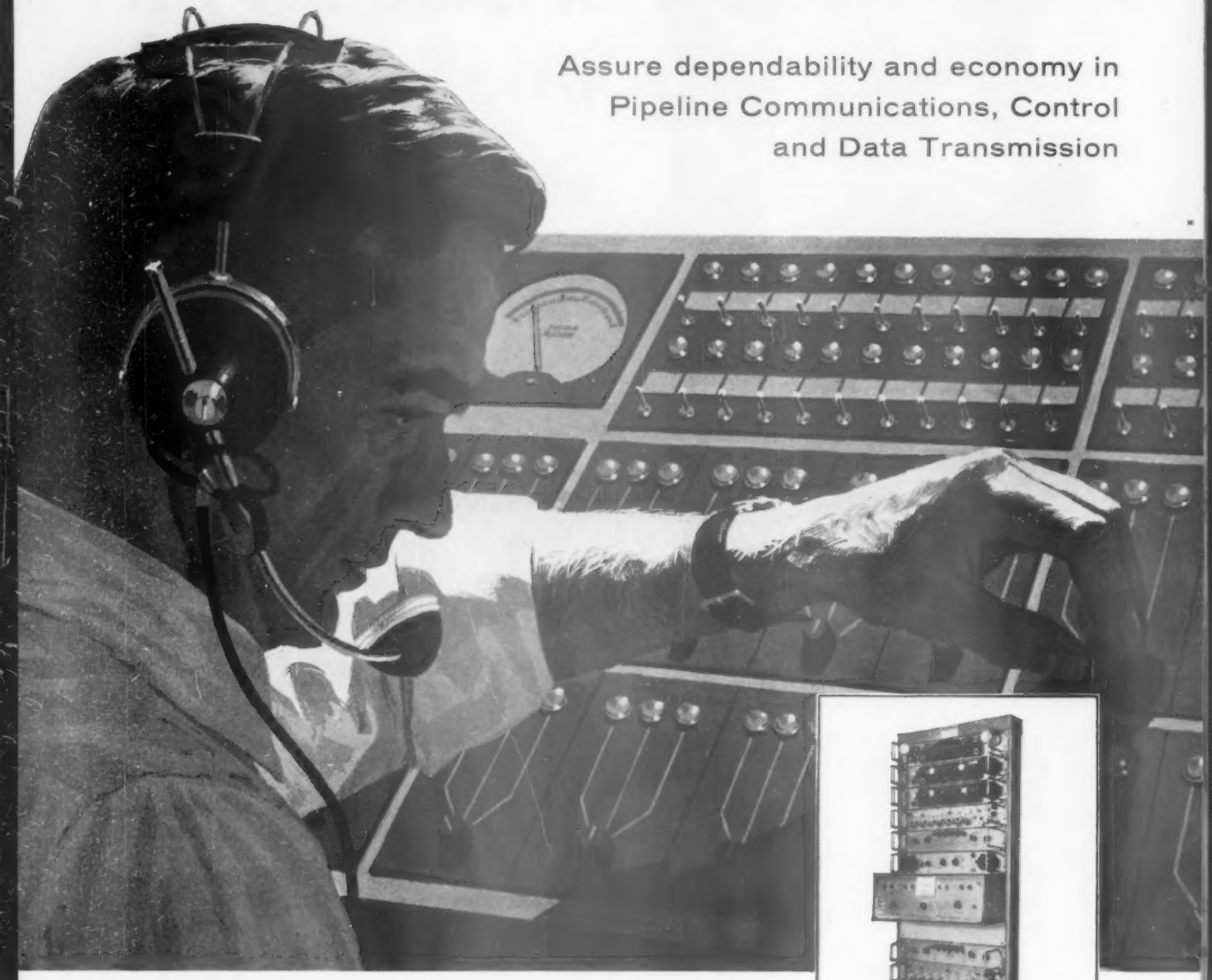
DUNCAN, OKLAHOMA



ANOTHER FIRST...FROM THE WORLD'S LEADER IN FORMATION FRACTURING

PHILCO MICROWAVE
COMMUNICATIONS SYSTEMS

Assure dependability and economy in
Pipeline Communications, Control
and Data Transmission



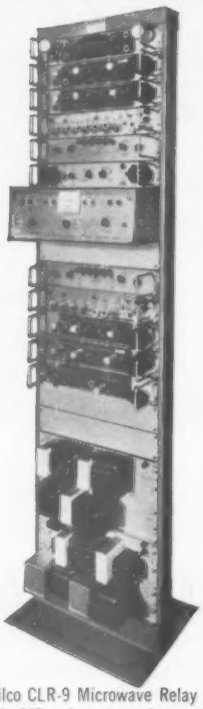
Philco microwave systems are known for dependability, flexibility and economy. Custom designed to meet each specific requirement—and featuring Philco's time-proved CLR-9 duplex microwave terminal—these systems provide highly reliable, unattended point-to-point communications facilities for voice, telemetering, VHF and remote control of pipeline operations . . . plus high speed data transmission. For the finest in microwave systems, specify Philco.

Benefit, too, from Philco's efficient TURNKEY SERVICES which include . . . Site Survey • System Planning • Installation • Field Service. We welcome your inquiries.

Government and Industrial Group, 4700 Wissahickon Ave., Philadelphia 44, Pa.
In Canada: Philco Corporation of Canada Limited, Don Mills, Ontario.

PHILCO®

Famous for Quality the World Over



Philco CLR-9 Microwave Relay . . . with 240 voice channel capacity. Available in Common Carrier, Industrial and Government bands.

* Practically Perfect!

HUMBLE COREXIT

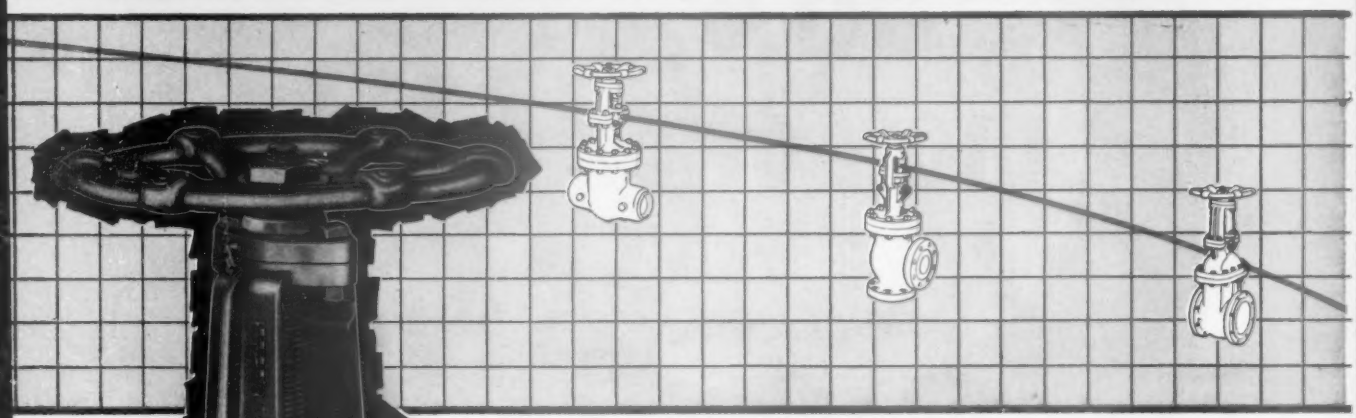
Save time and money previously lost to internal corrosion: use Humble COREXIT . . . COREXIT effectively and economically prevents internal corrosion in pipe still overhead, distillation towers, vapor recovery systems and other refining units. COREXIT will reduce or completely eliminate plugging or fouling. This protection against sludge, scale and corrosion cuts non-productive downtime to a minimum. For complete information on technical services and products, contact your Humble salesman.

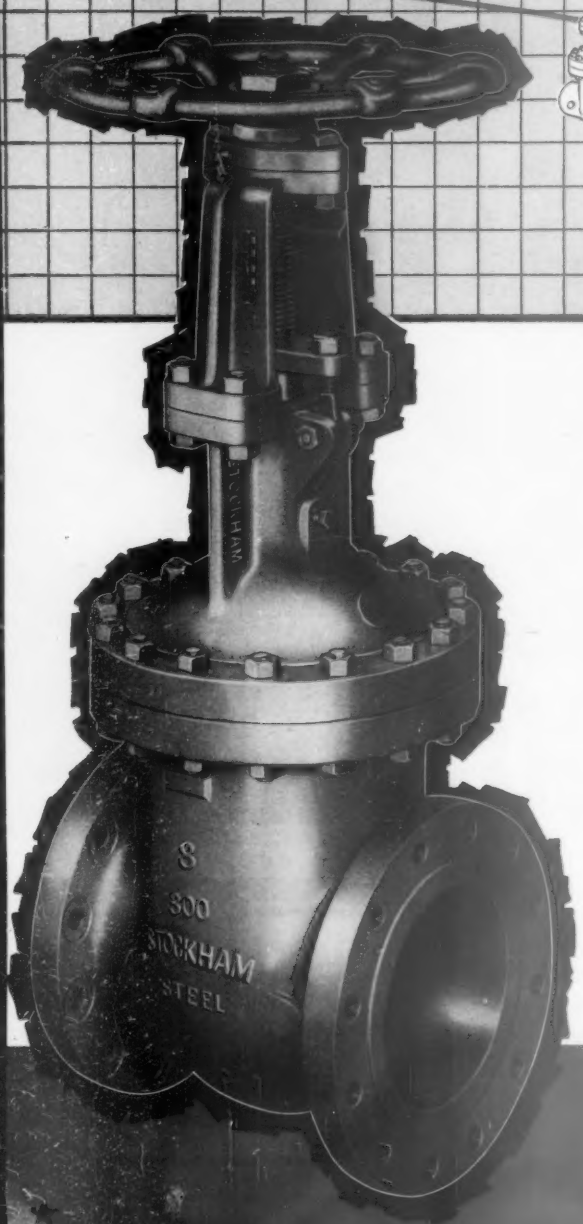
HUMBLE

HUMBLE OIL & REFINING COMPANY

Engineered to Cut Valve Maintenance Costs

STOCKHAM STEEL GATE VALVES





GET THE design features you want and need to cut costs—get quality that lasts—in Stockham Steel Gate Valves.

Get full pipe size straight through port design. Seat rings are slotted; **no lugs protrude** in flow area.

These features make it the **easiest conventional type gate** valve to use in "pigging lines" and "hot tapping"—far more economical than conduit designs.

Other superior cost-cutting features include:

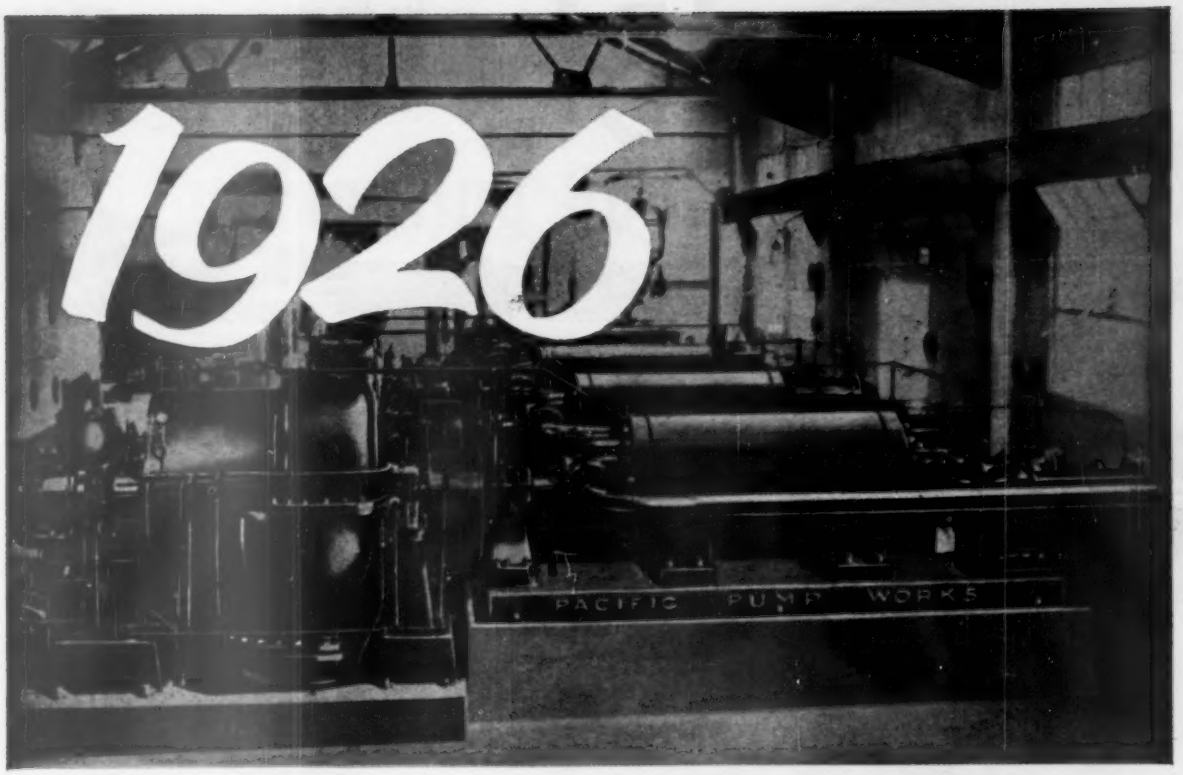
- ★ Disc and seat rings are precision ground for perfect seating
- ★ Disc guided throughout travel—eliminates wear
- ★ One piece yoke and cap—quick, easy maintenance
- ★ Non-corrosive copper nickel yoke bushing.

Precision quality control at every level of manufacture. Available in a wide variety of body and trim combinations. Gate, Globe, Angle and Swing Check Valves. 150, 300, and 600 Pound Pressure Classes.

STOCKHAM
VALVES *and* **FITTINGS**

4002 NORTH 18th AVENUE BIRMINGHAM 2, ALABAMA

SOLD ONLY THROUGH DISTRIBUTORS



PACIFIC PUMPS

first "FIRST"

The centrifugal pumps designed and built for Pan American Oil Company's new high-pressure cracking process in 1926 was one of the most significant engineering achievements of the Twenties in the refinery processing field. The first of many Pacific Pumps' "FIRSTS", this particular pump was the forerunner of today's greatly improved Pacific centrifugal process pump line. Over the years Pacific has built and installed thousands of vertical and horizontal centrifugal pumps for extreme pressures and temperatures demanded by the petroleum, chemical, petro-chemical and allied industries. In addition, Pacific designs and manufactures boiler feed pumps for the power industry, steam turbo-pumps for the marine and power generation fields, and plunger pumps for oil-well service.

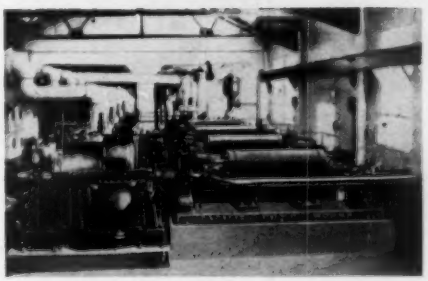
This first Pacific advertisement appeared in several petroleum publications early in 1927

Write for **Bulletin 1C**

PACIFIC

Offices in all Principal Cities

2000 POUNDS PRESSURE WITH CENTRIFUGAL PUMPS



View of recent installation of four "PACIFIC" Multi-stage Pumps at Pan American Petroleum Company Refinery, Los Angeles. Each Pump delivers a capacity of 400 Gallons Per Minute of Oil against a pressure of 2000 pounds. Pumps are driven by 750 H. P. Steam Turbines. Each Pump weighs nine tons and was required to pass a hydrostatic test of 5000 pounds pressure.

We are prepared to make prompt shipment of Booster Pumps for Pipe Line or High Pressure service. Special Pumps designed for unusual conditions.

PACIFIC PUMP WORKS

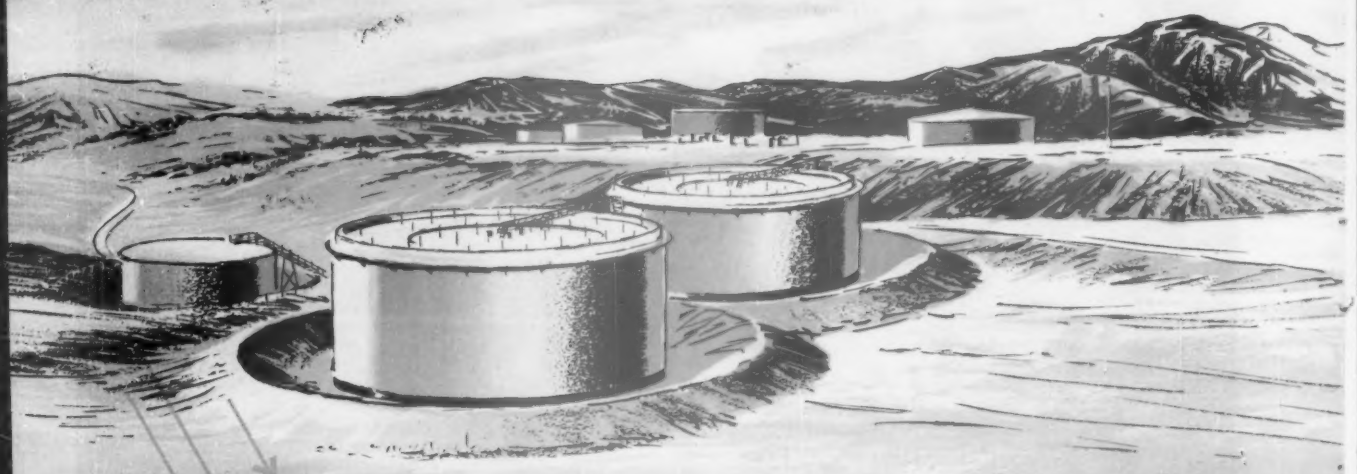
350 Bicket Street Huntington Park Los Angeles, Cal.

PACIFIC PUMPS

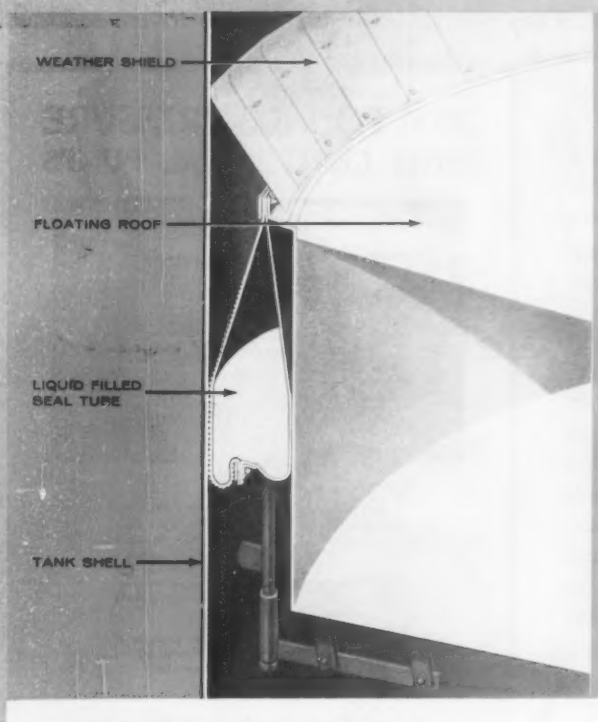
Inc. . . A Division of Dresser Industries, Inc.

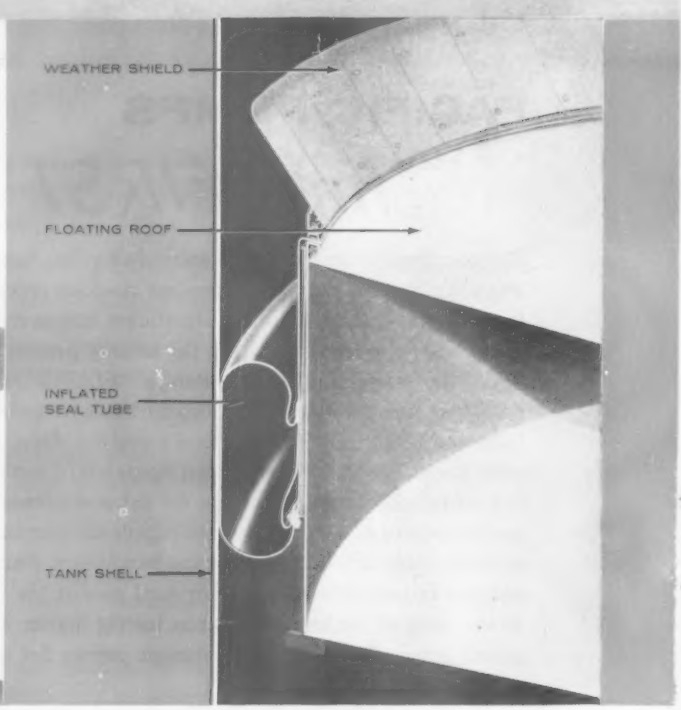
HUNTINGTON PARK, CALIFORNIA

CB&I OFFERS THE



FEATURES AND ADVANTAGES OF HORTON SEALS





SR5 / HORTON LIQUID FILLED FABRIC SEAL

- Sealing liquid holds envelope against tank shell.
- Pressure against shell is greatest at bottom, decreasing to zero at top of contact.
- Flexible ring support provides adequate clearance and better fit for all rim space variations.
- Sealing band and rim band vulcanized at bottom connection.

SR6 / HORTON INFLATED FABRIC SEAL

- Gas holds envelope against tank shell.
- Constant mild pressure, maintained by simple gasholder, over entire surface.
- Positive means of supplying seal gas.
- Maximum clearance to accommodate rim space variations due to badly out-of-round shells.
- Vulcanized to form endless tube.
- Can be serviced from top of roof.

WIDEST CHOICE OF SEALS
for Floating Roof Tanks

More CB&I-built floating roof tanks serve the petroleum industry than the total constructed by all other manufacturers. The reason . . . superiority of CB&I structures in design, construction and performance in reducing evaporation loss, retarding corrosion and minimizing fire hazard.

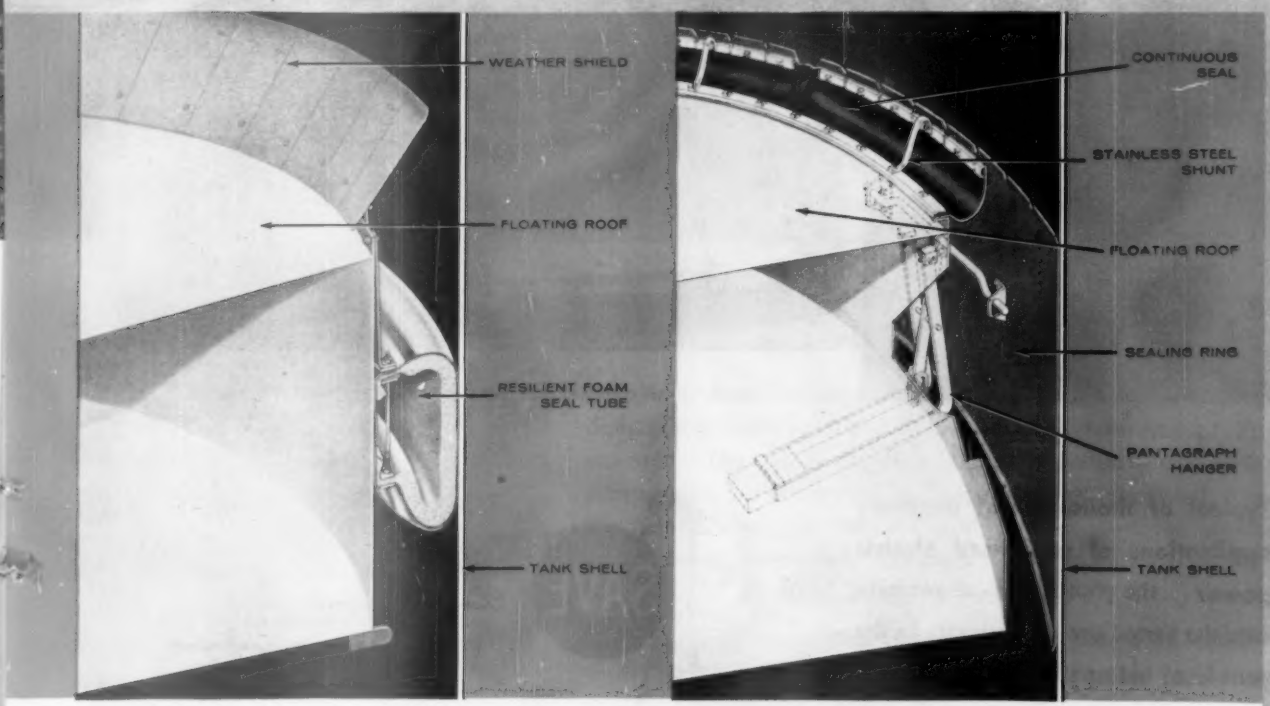
A key factor has been CB&I's continuous development of close-fitting, long-lasting Horton® Seals, which have set performance standards for the industry. Today, Horton Seals—both metallic and fabric—offer the widest selection of designs available anywhere.

CB&I's extensive experience (since 1922) with all types of sealing designs is at your disposal. For an accurate appraisal of the proper sealing mechanism for your specific storage conditions, call or write the nearest CB&I office.

CHICAGO BRIDGE & IRON COMPANY

332 SOUTH MICHIGAN AVENUE
CHICAGO 4, ILLINOIS

OFFICES AND SUBSIDIARIES IN PRINCIPAL CITIES THROUGHOUT THE WORLD



SR7 / HORTON RESILIENT FOAM FABRIC SEAL

- Resilient foam holds envelope against tank shell.
- Mild and positive pressure against tank shell.
- Maximum clearance to accommodate rim space variations due to badly out-of-round shells.
- Endless sheet covers resilient foam, forming tight envelope.
- Can be serviced from top of roof.

SR3 / HORTON METALLIC SEAL

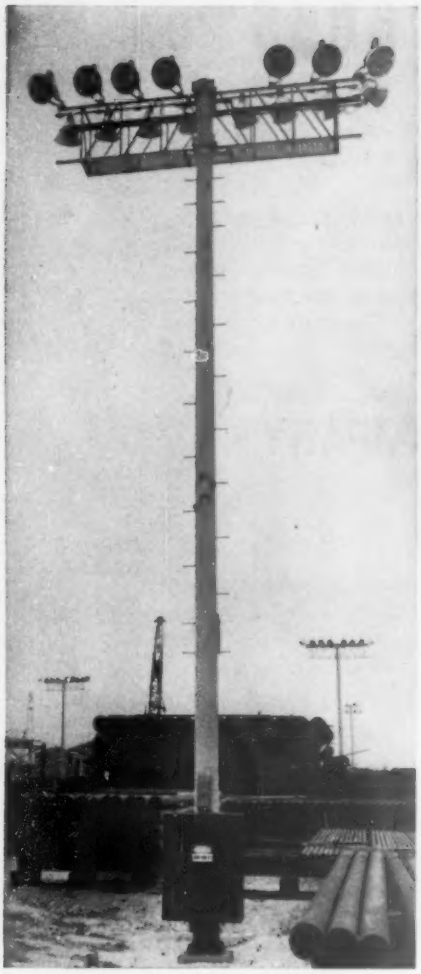
- Continuous steel sealing ring.
- Pantagraph hangers hold sealing ring against tank shell with minimum pressure.
- Hangers keep roof centered in tank.
- Continuous seal closes rim space.

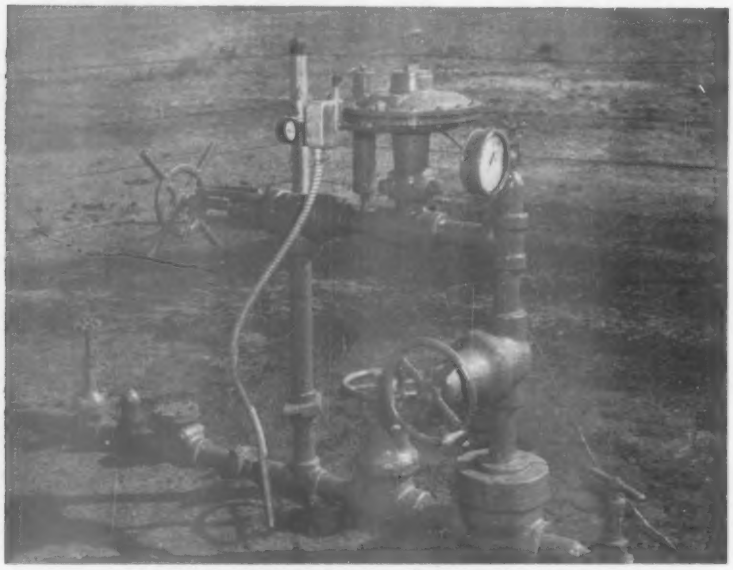
Horton Floating Roofs are covered by U. S. Patents and pending applications.

F9SCB

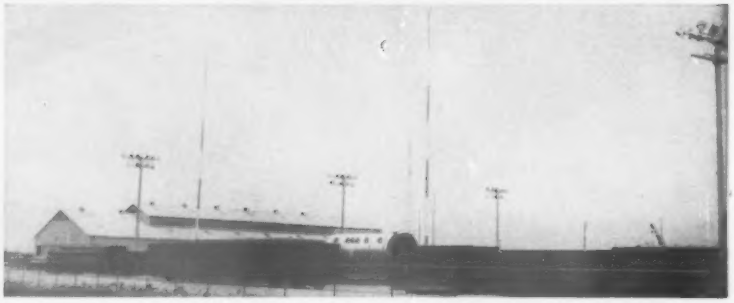
You can depend on purchased electric power for

AUXILIARIES





Electrically operated solenoid on flowing well with valve controlled by electric time-clock.



Lighting for oil company pipe storage yards and rail unloading areas.

Typical of thousands of auxiliary applications of purchased electric power... the photographs above indicate the varied use of electricity in the petroleum industry. The dependability and economy of utility electric power is fast proving the answer to many problems in oil producing, transporting and refining. Contact your nearest utility electric power company for full cooperation.

Purchased Electric Power . . .
saves money, manpower,
maintenance, and serves
you better automatically

Petroleum Electric Power Association

P.O. BOX 35006, DALLAS 35, TEXAS

"Install 'em anywhere – no maintenance needed"

PRODUCT OF W-K-M's

Creative Engineering

ACF non-lubricated Ball Valves feature Teflon stem gaskets and seats. There's no lubricant to cause sticking or contamination.

Working Pressures: In carbon steel with ASA ratings of 150 pound and 300 pound, and some sizes in ASA 600 pound; in semi-steel with 200 and 400 pound WOG ratings.

Sizes: ½" through 6". Regular port valves up to 8" x 6".

5922

acf non-lubricated Ball Valves

ACF Ball Valves are not only non-lubricated . . . but designed *throughout* for maintenance-free performance. For example: The ball is suspended between Teflon* seats under compression for leakproof sealing. Seats are protected from the lading flow. And the full bore conduit provides *smooth* flow, with no destructive turbulence . . . no more pressure drop than through an equal length of pipe.

A quick quarter-turn operates this rugged valve. Specify it. You'll get efficient, economical performance. *Available from leading suppliers everywhere.*

* Du Pont Trademark

WRITE FOR CATALOG 1000

W-K-M

DIVISION OF acf INDUSTRIES
INCORPORATED
P. O. BOX 2117, HOUSTON, TEXAS

ROLLWAY MAXIMUM BEARINGS

. . . . . What's the limit: Heat? Shock? Speed? Or complicated radial and thrust loads?

Name the combination of requirements . . . and chances are you'll find them met by a Rollway Maximum precision radial cylindrical roller bearing. If not, then Rollway engineers will modify any factor to meet your application.

Rollers are crowned to prevent end-loading and the resultant spalling of races. Directional trueness is maintained by retainers of standard bronze or "Rollube" ferrous alloy of one piece or two piece construction.

You may wish to refer to the Rollway Catalog and Engineering Data Book when writing specifications for a high precision bearing. It contains the first listing, by any manufacturer, of the thrust capacities of cylindrical radial roller bearings. Send for it today.

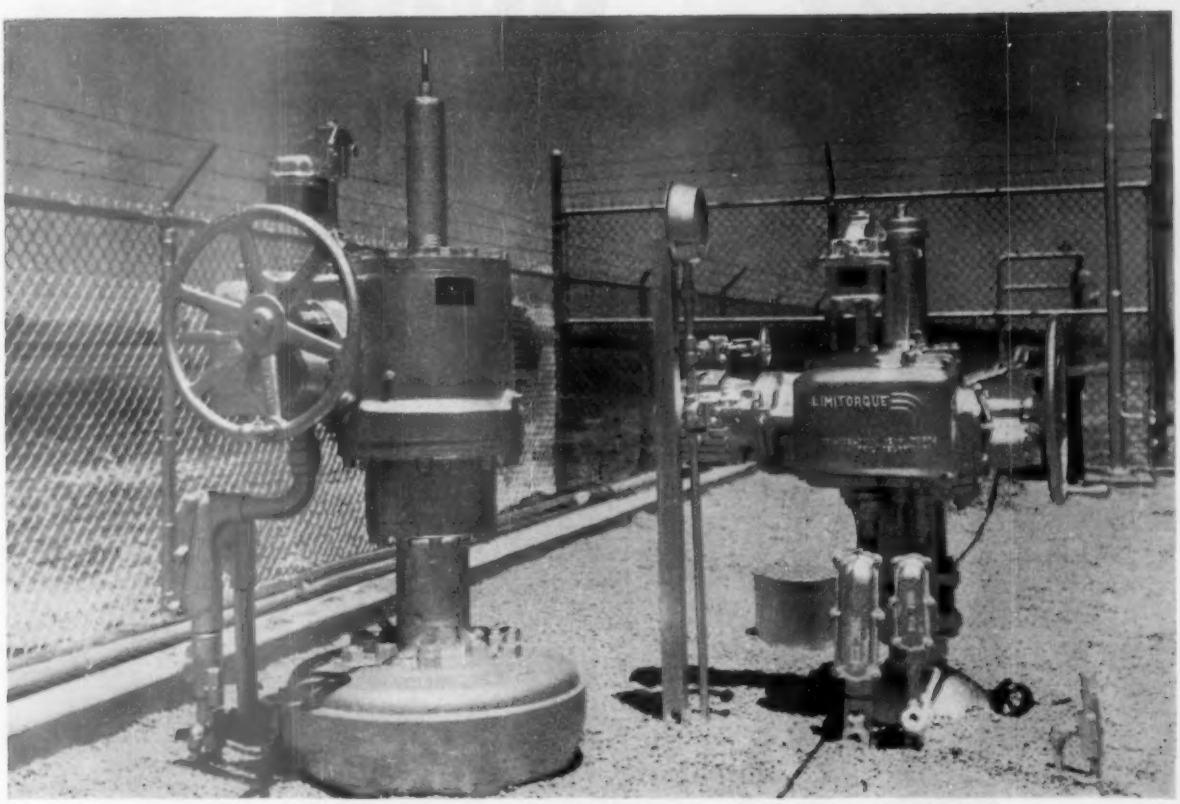
ENGINEERING OFFICES:

Syracuse Boston Chicago Detroit
Toronto Pittsburgh Cleveland
Seattle Houston Philadelphia
Los Angeles San Francisco

ROLLWAY®
BEARINGS
COMPLETE LINE OF RADIAL AND THRUST CYLINDRICAL ROLLER BEARINGS

LimiTorque

on Mainline Block and Delivery Valves



...at PERRY STREET STATION OF FOUR CORNERS PIPE LINE COMPANY

The W-K-M Valve shown at the left is on the main line block, while the Darling Valve at the right is on the delivery line . . . This installation is one of several take-off points on the pipeline.

In this station, as in many other high pressure oil and gas transmission lines and refineries throughout the World, LimiTorque Operators are widely used . . . because they are accurate, rugged, and absolutely dependable at all times.

LimiTorque opens and closes valves from a conveniently located control point—eliminating guess-work and reducing labor costs . . . One man can control any type of valve in remote, inaccessible or hazardous locations—and LimiTorque eliminates any possible damage to valve operating parts during operation, due to its unique Torque-Limiting Mechanism—and LimiTorque is available for Electric or Air Motor Operation . . . Contact your valve manufacturer or nearest LimiTorque Sales-Engineering Office.

Send for complete Catalog L-550 and please use your Business Letterhead when requesting a copy.

THERE IS NO SUBSTITUTE FOR —

LimiTorque®

PHILADELPHIA GEAR CORPORATION

KING OF PRUSSIA (SUBURBAN PHILADELPHIA), PA.

Offices in all Principal Cities

INDUSTRIAL GEARS & SPEED REDUCERS • LIMITORQUE VALVE CONTROLS • FLUID AGITATORS • FLEXIBLE COUPLINGS

Limitorque Corporation • King of Prussia, Penna.

SHORT COMPACT RUGGED

GUIBERSON'S SHORTY TENSION PACKER for WATER FLOODING

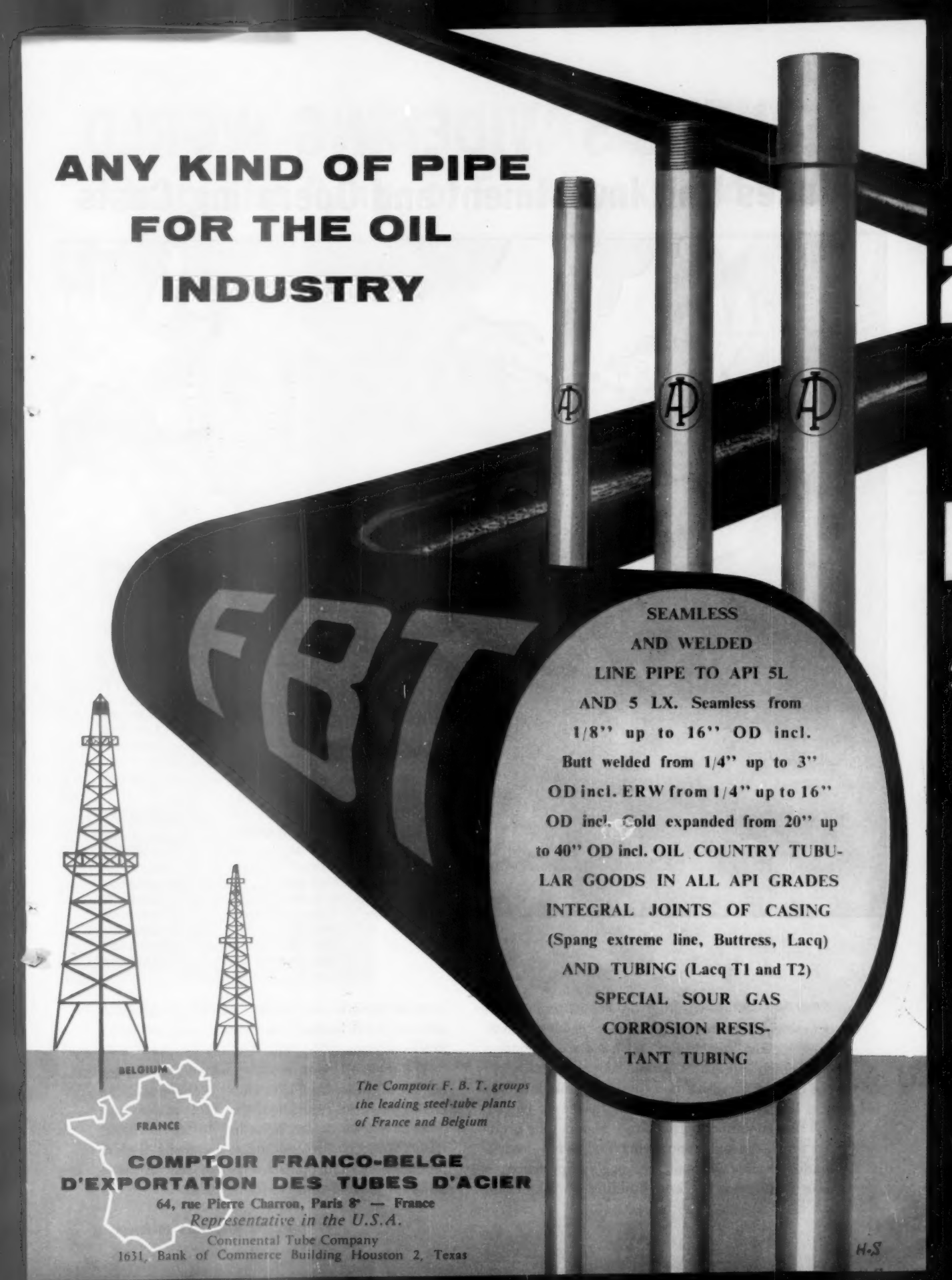
Here is a rugged, low-cost retrievable tension packer that's short and easy to handle. Uncomplicated and functional in design, it's easy to set, space out and spot . . tension set by pulling on tubing string. And Guiberson's shorty tension packer is priced to cut your costs . . designed especially for water flood injection wells.

SAFETY JOINT COUPLING: right hand release 8 round thread for added safety.
ANCHOR CAGE: one piece malleable iron.
MANDREL: full opening heavy one piece seamless steel tubing.
LATCH: dependable J-slot mechanism, shock-absorber equipped, independent of safety joint operation.
FRICTION PADS: heat-treated pearlitic malleable iron.
SLIPS: heat-treated alloy steel.
HEADS: drillable cast iron.
RUBBER: specially compounded to withstand the most rugged oilfield use at high pressures and temperatures—built-in ability to return to original shape.
THIMBLE: drillable cast iron.
SAFETY RELEASE NUT: predetermined tension load at packer strips out, leaving safety nut, thimble, rubber and head—all drillable.

Sold by Oil Field Supply Stores Everywhere

THE GUIBERSON CORPORATION
ESTABLISHED 1919 — DALLAS, TEXAS U. S. A.

ANY KIND OF PIPE FOR THE OIL INDUSTRY



SEAMLESS AND WELDED LINE PIPE TO API 5L AND 5 LX. Seamless from 1/8" up to 16" OD incl. Butt welded from 1/4" up to 3" OD incl. ERW from 1/4" up to 16" OD incl. Cold expanded from 20" up to 40" OD incl. OIL COUNTRY TUBULAR GOODS IN ALL API GRADES INTEGRAL JOINTS OF CASING (Spang extreme line, Buttress, Lacq) AND TUBING (Lacq T1 and T2) SPECIAL SOUR GAS CORROSION RESISTANT TUBING

The Comptoir F. B. T. groups the leading steel-tube plants of France and Belgium

COMPTOIR FRANCO-BELGE D'EXPORTATION DES TUBES D'ACIER

64, rue Pierre Charron, Paris 8e — France

Representative in the U.S.A.

Continental Tube Company

1631, Bank of Commerce Building Houston 2, Texas

H.S

KELLOGG'S WIDENING WORLD

Reduces Unit Investment and Operating Costs

Kellogg Alkylation Units Throughout The Refining World

ARGENTINA	
Lujan de Cuyo, Mendoza	1,600 BPD
AUSTRALIA	
Melbourne	2,000 BPD
Sydney	3,400 BPD*
CANADA	
Vancouver, B.C.	1,000 BPD
Calgary, Alberta	1,500 BPD
Montreal, Quebec	1,600 BPD
CHILE	
Concon	1,100 BPD
IRAN	
Abadan	6,000 BPD
SAUDI ARABIA	
Ras Tanara	1,400 BPD
UNITED STATES	
East Chicago, Ind.	2,600 BPD
Beaumont, Texas	5,000 BPD
Texas City, Texas	3,500 BPD
Whiting, Ind.	5,000 BPD
Lake Charles, La.	12,750 BPD
Lake Charles, La.	10,675 BPD

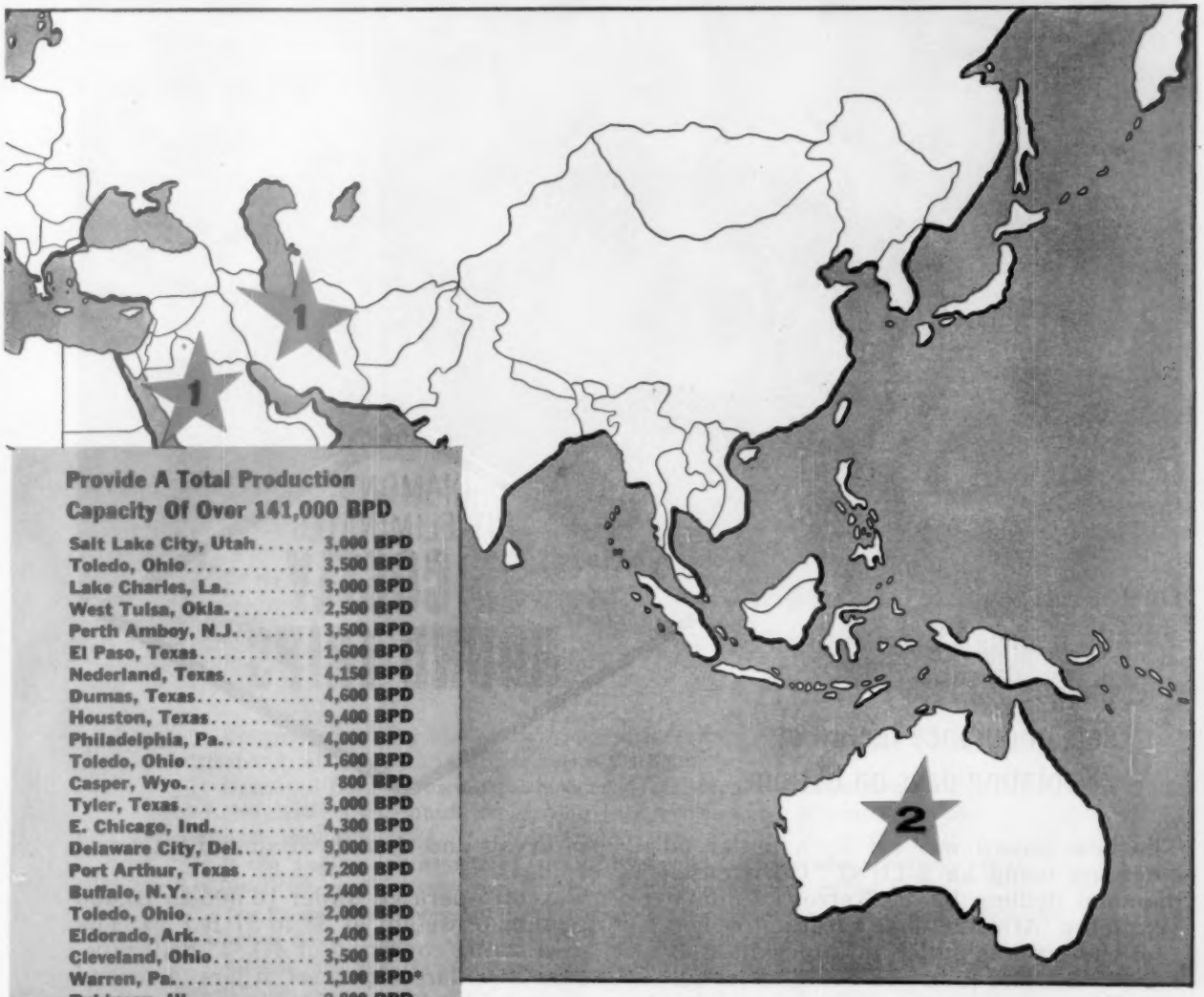
FOR REFINERS wishing to increase their barrel octane for the lowest optimum over-all expenditure, Kellogg can design and build an alkylation unit which will utilize normal refinery feeds, yield the desired quantity and quality of alkylate, yet cost less to install and operate than ever before.

This economic approach to a high octane product for the gasoline pool, when and as required, is made possible through Kellogg's experience to date in engineering and building 38 alkylation units of various designs, for both large and small refiners, in 6 foreign countries as well as in 13 States at home.

The most efficient, most economical, and most flexible of these alkylation units are those utilizing Kellogg's most recent sulfuric acid, multi-stage cascade reactor design. Whether for 500 or 15,000 BPD, Kellogg can undertake the entire design, procurement, and construction of one of these units for a lump-sum contract.

OF ALKYLATION EXPERIENCE

—Increases Range of Feedstocks and Yields



Provide A Total Production Capacity Of Over 141,000 BPD

Salt Lake City, Utah	3,000 BPD
Toledo, Ohio	3,500 BPD
Lake Charles, La.	3,000 BPD
West Tulsa, Okla.	2,500 BPD
Perth Amboy, N.J.	3,500 BPD
El Paso, Texas	1,600 BPD
Nederland, Texas	4,150 BPD
Dumas, Texas	4,600 BPD
Houston, Texas	9,400 BPD
Philadelphia, Pa.	4,000 BPD
Toledo, Ohio	1,600 BPD
Casper, Wyo.	800 BPD
Tyler, Texas	3,000 BPD
E. Chicago, Ind.	4,300 BPD
Delaware City, Del.	9,000 BPD
Port Arthur, Texas	7,200 BPD
Buffalo, N.Y.	2,400 BPD
Toledo, Ohio	2,000 BPD
Eldorado, Ark.	2,400 BPD
Cleveland, Ohio	3,500 BPD
Warren, Pa.	1,100 BPD*
Robinson, Ill.	2,800 BPD
Toledo, Ohio	3,500 BPD

*Future

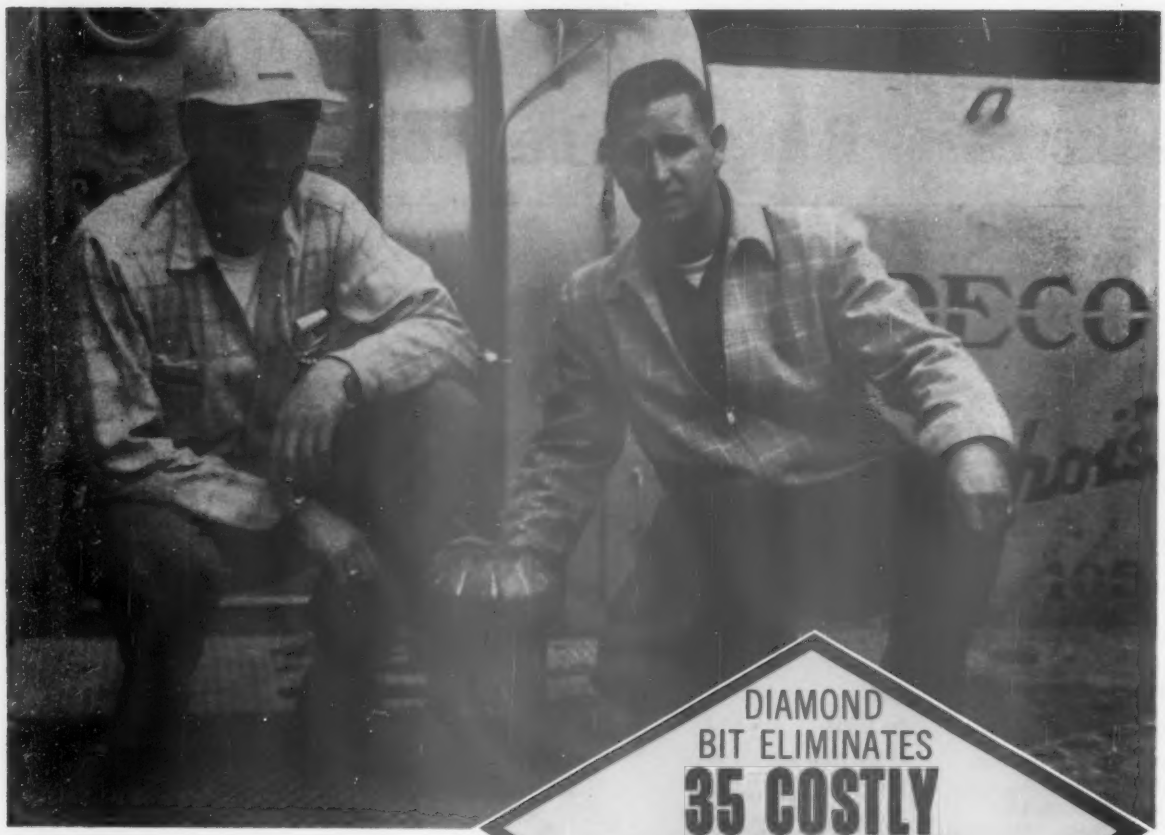
Designed to operate on butylene, propylene, amylenes, or a combination feed, these new units offer many advantages over other models. They can produce an LPG product, as well as high octane alkylate, without supplementary towers or equipment. They reduce corrosion to a minimum without extensive use of expensive chemicals. They are extremely low on acid consumption—using, for example, less than 0.3 sulfuric acid per gallon of alkylate. They are adaptable to seasonal demands—capable of maintaining peak barrel octane production at minimum operating cost.

Kellogg welcomes the opportunity to discuss the details of its alkylation process with you.

THE M. W. KELLOGG COMPANY

711 Third Ave., New York 17 *A subsidiary of Pullman Incorporated*

Offices of Kellogg subsidiary companies are in Toronto, London, Paris, Rio de Janeiro, Caracas, Buenos Aires



Christensen Diamond Drilling Bit sets endurance record of 28 rotating days on bottom

The new record was set by a major oil company using an 8-11/32" Christensen diamond drilling bit in Natrona County, Wyoming. After 28 days rotating on bottom the bit was pulled at approximately 16,000 feet and found to be in fair condition. The operating company estimated that 35 round trips and 35 conventional bits would have been needed to drill the same intervals and that the diamond bit saved 18 days.

The bit operated under 10,000 to 16,000 pounds of weight at 53 to 57 R.P.M. The drill string consisted of 4-1/2" drill pipe, nine 7" collars with a set of jars. A second diamond bit had no trouble reaching bottom and ran for 16 rotating days, also surpassing the old 13 day record for the area.

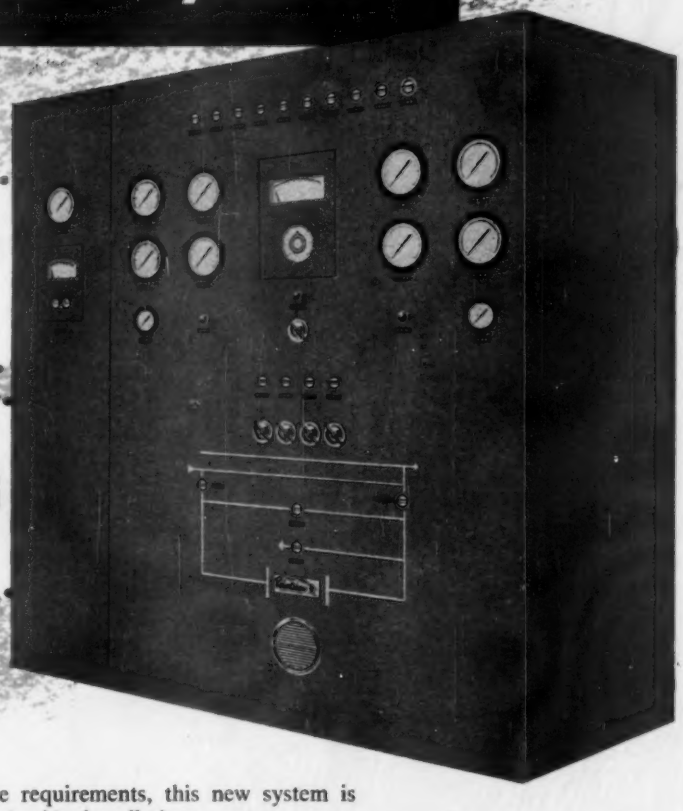
For "Less Cost Per Foot" drilling, contact Christensen Diamond Products Company for information about its complete line of diamond bits and core barrels.

"Less cost per foot."

CHRISTENSEN DIAMOND PRODUCTS

MAIN OFFICE AND PLANT 1937 SOUTH 2nd WEST
P. O. BOX 387 SALT LAKE CITY, UTAH

Robertshaw Pneumatic Engine Control System



Automatic Warning or Shutdown Prevents Engine Damage

Start/Stop Functions Interlocked and Sequence-Controlled

Designed specifically for pipeline requirements, this new system is adaptable to all internal combustion engine installations.

Developed from standardized components—engineered and manufactured by Robertshaw for one-source responsibility—the system is fully pneumatic . . . and completely automatic.

It can monitor any number of measured variables of temperature, pressure, vibration, level, etc.; and instantly signals when any variable exceeds pre-set limits.

The Safety System prevents engine damage from malfunction or abnormal conditions by shutting down engine if condition is critical; if not, it signals a warning.

All start and stop operations are controlled in sequence and completely interlocked.

Every system is custom engineered to meet specific requirements, is tested as a complete system before shipment, and is backed by Robertshaw's world-wide engineering organization.

For further information, write for Bulletin KO-760. **Fulton Sylphon Division, Robertshaw-Fulton Controls Co., Knoxville 1, Tennessee**

See it demonstrated . . .
ASME POWER SHOW

Robertshaw

MR. CONTROLS

Storage can be simple

A phone call to General American solves all *your* bulk liquid storage problems.

General American has *six* terminals close to the nation's top markets, where you can *lease* as much or as little tankage as you require.

When you store with General American, you have no capital investment, no operating problems. You have *flexibility* of inventory and product to meet your needs and the market's opportunities. Tanks can be bonded, if desired. You enjoy complete privacy, with experienced crews on hand to operate individual pipe lines. Blending and packaging equipment, loading docks and other facilities are available as needed.

Your warehouse receipts are A-1 collateral.

Ask the nearest General American office about terminal facilities.

It pays to plan with General American.

Terminals Division

GENERAL AMERICAN TRANSPORTATION CORPORATION

135 South LaSalle Street • Chicago 3, Illinois

Offices in principal cities

TANK STORAGE TERMINALS GENERAL AMERICAN TRADE MARK

Terminals located at Carteret, N.J.; (Port of New York) Argo, Ill.; (Port of Chicago) Corpus Christi, Texas; Galena Park and Pasadena, Texas; (Port of Houston) Good Hope, La. (Port of New Orleans).

PRODUCT IMPROVEMENT WITH

PETRECO

ELECTROFINING

Electric Precipitator Treating ... ON THE JOB THROUGHOUT REFINERIES ... THROUGHOUT THE WORLD!

DO YOU HAVE ONE OF THESE TREATING PROBLEMS?

(Successfully Treated the ELECTROFINING Way!)

If you have a treating problem, ELECTROFINING* Electric Precipitator Treating might well provide the answer. It has, for refineries all over the world—in improving and stabilizing streams from many different types of refining units.

The table shown here lists some of the places in which ELECTROFINING units are successfully being used, some of the stocks being treated, some of the treatments applied and some of the product improvements gained by the process.

It is equally important to note that the ELECTROFINING process permits intimate and instantaneous contact between hydrocarbon and chemical treating agents, assuring immediate separation with minimum carry-over or effluent pollution. The process is precise, automatic and continuous.

ELECTROFINING PRECIPITATORS USED WITH THESE UNITS	PRODUCT STREAMS TREATED	TYPE OF TREATMENT	PRODUCT IMPROVEMENT
Crude Distillation	S. R. Gasoline	Water Removal	Gum Reduction
Thermal Cracking	Cat. Gasoline	Water Wash	Sweetening
Catalytic Cracking	Diesel Fuel	Caustic Wash	RSH Removal
Vacuum Flashing	Jet Fuel	Acid Treat	Organic Acid Removal
Hydrotreating	Kerosine	Acid-Caustic	Olefins Removal
Reforming	Cat. Cycle Oil	Caustic-Water	Color Improvement
Alkylation	Lube Distillates	Doctor Treat	Improvement of Viscosity Index
	Cracked Fuels	Sulfonation	Sedimentation Prevention
	Virgin Gas Oil		
Detergent Alkylation	Heavy Cat. Gaso.	Acid Precipitation	Color Stabilization
	Alkylation Products	Caustic-Sodium	Savings in Product
	S. R. Naphtha	Sulfite Treat	Haze Prevention
	No. 1 Fuel		Savings in Treating Chemicals
	No. 2 Fuel		Odor Improvement
	SO_2 Raffinate		Pollution Prevention
	SO_2 Extract		Sodium Ion Removal
	Coker Naphtha		Nitrogen Removal
	Spray Oils		Arsenic Removal
	Poly Gasoline		Naphthenic Acid Removal
	Benzine Alkylate		Tarry Acid Removal
	Re-refined Lube		Thiophene Removal
	Hydrofined Varsol		
	Hydrofined Sour Gas Oil		

GET THE COMPLETE ELECTROFINING STORY from your local PETRECO Engineer, or write to ...

*Registered trademark of Petrolite Corporation

DT-60-3

PETROLITE CORPORATION

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HANDLES "MOON" TEMPERATURE EXTREMES!

New low temperature insulation handles jobs in − 300° F. to + 220° F. range

Of course, this new Unarco U200 insulation is not in use on the moon . . . but it could be, because it handles temperature extremes even greater than would be required on this bleak island in space.* What's more U200 does it without thermal shock effects anywhere along the line.

A new, extremely lightweight, closed cell synthetic, U200 has excellent heat and chemical resistance. Its K factor is only 0.14 at 70° F. mean temperature . . . lowest on the market. Density is only 2.3 lb. per cubic foot. Yet this remarkable, new material has high compressive and flexural strength. It's non-toxic and easy to handle, too.

Try it just once and you'll see how quickly and easily it can be cut and applied with a very minimum of standard hand tools. It can actually reduce application costs by as much as 50%.

Available in accurate, half-round sections; in nominal thicknesses and in standard pipe sizes. Individual sections 36 inches long. Also available in 12" x 36" block form—1" to 5" thickness in ½" increments.

(*) *−243° F. to +214° F. Estimated moon temperatures as listed in a leading American encyclopedia.*

Get complete engineering specifications and other details before another day goes by.

Write today on your company letterhead for Unarco Bulletin No. U200-1.

MILLIONS OF CLOSED CELLS MAKE U-200

- Waterproof
- Vapor Resistant
- Efficient
- Lightweight
- Easy to Handle

*Closed cell content of 85% plus.

U-200 POLYURETHANE FOAM

The insulation with "Handleability"

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UNARCO PRODUCTS

• UNIBESTOS, Amosite Asbestos Pipe Covering and Block • Calcium Silicate Pipe Covering and Block • 85% Magnesia Pipe Covering and Block • Mineral Fiber Block • Wrap-On Insulation • Lace-On Insulation • Turbine Blankets • Insulating and Finishing Cements • Asbestos Textiles • Packing and Gasketing.

UNION ASBESTOS & RUBBER COMPANY

Fibrous Products Division • **Dept. 237, Bloomington, Illinois.**

look to Parsons FOR PERFORMANCE

FIRST THOUSAND TON SULFUR PLANT NOW ON STREAM

SOCIETE NATIONALE DES PETROLES D'AQUITAINE (SNPA) Lacq, France, has put the world's first 1,000 LT/D plant on stream recovering sulfur from sour natural gas. This plant, the world's largest, is another example of Parsons' engineering and construction performance. Eight contracts by SNPA, covering various units of the Lacq facility, demonstrate customer satisfaction with Parsons' performance. The Ralph M. Parsons Company, Los Angeles. United States Offices: Houston, Huntsville, New York, Washington. International Offices: Ankara, Asmara, Baghdad, Bangkok, Cairo, Calgary, Dacca, Jeddah, Karachi, New Delhi, Paris, Teheran, Toronto.

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WORLD-WIDE SERVICES: Petroleum-Chemical Engineering/Construction/Architect-Engineering/ Electronic Systems and Components/Water Development and Systems/Appraisals and Economic Studies/Plant Operation/Personnel Training/

*In Collaboration with S. A. Heurtey Company

How Timken® steel became a string saver

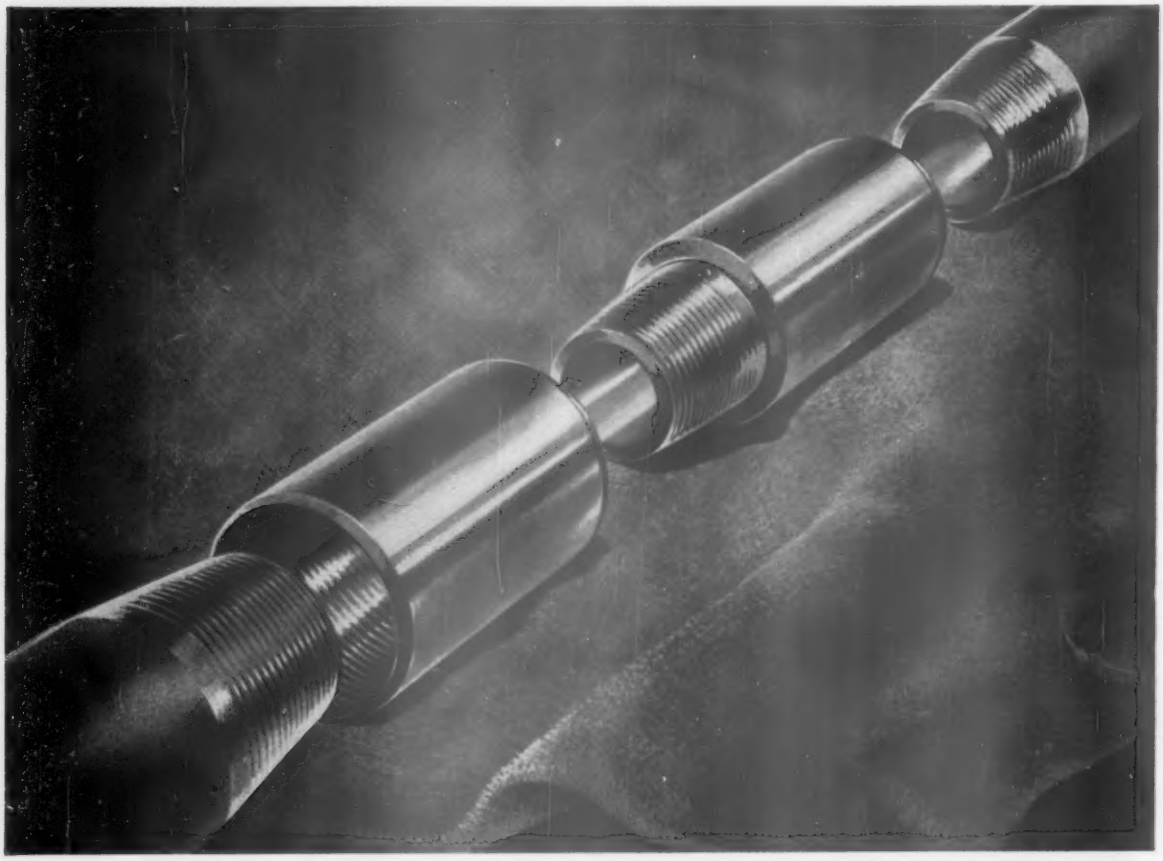
YOU probably recognize the steel parts below as tool joints that hold together a string of drill pipe. Deep hole drilling puts a terrific strain on these joints. And a break is costly in both time and money.

Manufacturers came to Timken Company metallurgists to solve their breakage problem. Our experts studied the problem and recommended a special analysis of Timken seamless steel tubing.

The manufacturers tested it. They found the refined grain structure and spiral grain flow of the Timken tubing gave joints the fine forged quality they need to resist string failure. Big economies in time and money resulted.

You'll also find Timken steel the most economical you can use for high-strength casing, drill collars, pumps, and refinery tubes and piping. Whatever the application, Timken steel tubing cuts production time and material costs—the hole's already there!

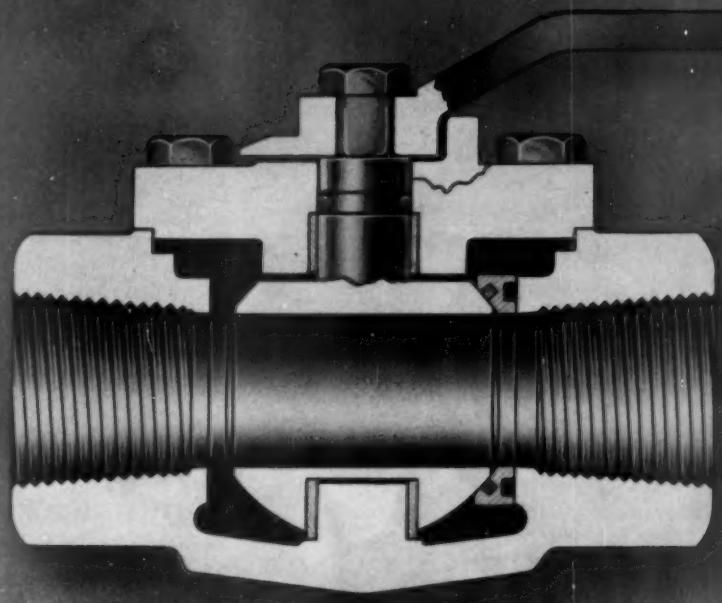
We've even developed a new high-strength oil well tubing that offers a yield strength up to 125,000 PSI —20% stronger than the stiffest API spec, 5A. Whatever your steel problem, Timken Company metallurgists are ready to help you solve it. Why not give them a call? ***When you buy Timken steel you get . . .*** *1) Quality that's uniform from heat to heat, bar to bar, order to order. 2) Service from the experts in specialty steels. 3) Over 40 years experience in solving tough steel problems.* The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable: "TIMROSCO". *Makers of Tapered Roller Bearings, Fine Alloy Steel and Removable Rock Bits.*



TIMKEN® *Fine Alloy* STEEL

TIMKEN ALLOY STEEL AND SEAMLESS TUBING IS AVAILABLE FROM WAREHOUSE STOCK IN 44 CITIES IN THE UNITED STATES

...how can 1 valve replace 3?



Better **FLOW** *than a* **GATE...**

but, unlike gates, the *FLO•BALL* valve doesn't freeze or jam . . . it never leaks . . . the seats don't score . . . it requires no maintenance . . . and just a ¼ turn opens or closes it.

Better **SEALING** *than a* **GLOBE...**

but, unlike globes, *FLO•BALL* gives zero leakage . . . in both directions *without* seat distortion . . . closes easily without massive operators . . . gives more than twice the flow . . . and the fastest action of any valve made.

Better **RELIABILITY** *than a* **PLUG...**

but, unlike plugs, *FLO•BALL never* needs lubrication . . . never freezes, never leaks, requires no maintenance . . . yet it has greater flow capacity than any plug . . . and the *lowest* torque in the industry.

FLO•BALL® does it . . . and does it better!

Hydromatics, Inc.
LIVINGSTON, NEW JERSEY

FLO-BALL

Mail this postage-free card today!

Bearing-fixed ***FLO•BALL*** valves are stocked with flanged or screwed ends, full or reduced port, in standard sizes from ⅛" to 10". They are made to standard ASA dimensions in carbon steel and 316 stainless steel.

Gentlemen:

Perhaps your bearing-fixed ***FLO•BALL*** valves can fill my applications. I require valves

for _____

_____ in these sizes _____

I now use ball valves in these sizes _____

PLEASE: ☐ Have salesman call ☐ Send technical data

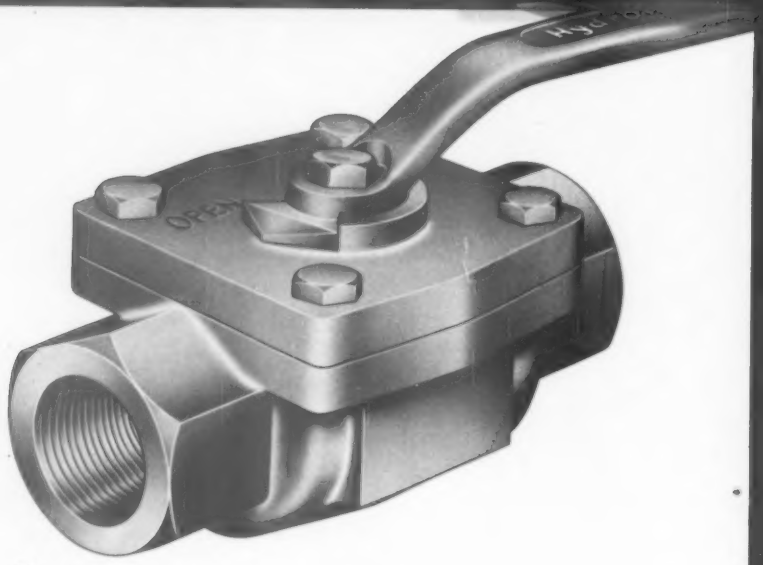
My name _____ Position _____

Company name _____

Address _____

City _____ State _____

...how the FLO•BALL® reduces your valve costs 3 ways!



1. Reduce initial costs . . . *by using fewer valves per system. FLO•BALL valves are used in place of gates, globes, or plugs.*

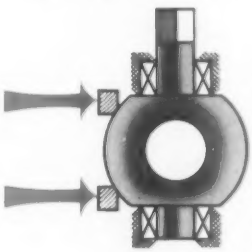
2. Reduce inventory costs . . . *by standardizing on one type valve for all applications requiring gates, globes, or plugs.*

3. Reduce maintenance costs . . . *the FLO•BALL high reliability means less maintenance . . . no lubrication, no freezing, positive sealing. The top loading and replaceable seat reduces overhaul and start-up costs.*

Principles of Operation

In the bearing-fixed FLO•BALL valve all pressure forces exerted on the ball are transmitted to low-friction bearings. The pressure balanced seat results in a sealing force which is designed to insure positive sealing without seat distortion, and to minimize seat-resisting frictional forces. The combination of these low frictional forces accounts for the extremely low operating torque.

FLO•BALL VALVE
Fixes ball • Floats seat



FIRST CLASS PERMIT NO. 40

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Mail this postage-free card today!

CONTACTOR NUMBER 3

AMINE PROCESS DESIGN AND OPERATING INFORMATION

While ethanolamines are an excellent medium for treating gas, their satisfactory application depends on proper use of the amines and correct design of mechanical equipment. Some of these important design and operating considerations will be discussed in this series.

Maximum Stripping in Still is Essential

Insufficient stripping is a serious problem in amine plant operation. If all of the rich solution stripping is not done in the still, then a great deal of it will be done in the reboiler . . . causing very severe tube erosion and corrosion.

Good design calls for two or more stills in parallel to provide correct still area. Fluctuations in still loading can then be met by using one or the other. Economic considerations, however, may prevent this practice.

In cases where a plant is in operation and residual CO_2 in the lean amine goes above 1 cu. ft./gal. of solution, there are three ways to increase stripping:

1. Increase heat to the reboilers which will drive more steam up the column.

2. In a bubble cap column, alternate rows of caps can be blanked off to increase contact efficiency.

3. Increase liquid circulation. (This, however, will also increase steam consumption.)

Blanketing is Beneficial

To reduce oxidation of amine solutions and to avoid attendant corrosion problems, surge tanks, sumps and all parts of the system should be blanketed with oxygen-free gas. Wherever possible, oxygen should be excluded from the gas being treated.

When treating oxygen-containing gas, close attention to reclaimer design is necessary. The capacity of the reclaimer should be sufficient to maintain a low concentration of oxidation products.

Any amine solution which has been recovered from system leaks, and is to be returned to the system, should be returned only through the reclaimer.

Avoid Solution Overloading

Amine treating can be overdone, and any effort to dissolve too much acid gas usually results in trouble. Four cu. ft. of acid gas/gal. of solution is about the limit. Above this amount (in terms of a 15% solution of NEA), the bicarbonate or acid salt forms, aggravating corrosion by pH and CO_2 evolution effects.

Many difficulties can be attributed to improper solution loading. Exceeding the recommended amount for limited periods will not seriously damage a plant . . . providing it isn't done repeatedly.

It has been found in plant operation that it is difficult to justify using a 20% NEA solution (or higher) due to the problem of regeneration. Reference to equilibrium data in NEA literature will prove this to be true.

Low Reactivator Temperatures Reduce Corrosion

Because CO_2 and H_2S are inherently corrosive in the presence of water at elevated temperatures, amine reactivator temperatures should be kept to a minimum (235-245°F). These gases require pressures of 8-13 psig. at the base of the reactivator. Holding to this range of temperature and pressure will help in these ways:

1. It will minimize the inherent corrosiveness of the system;

2. Corrosion inhibiting films are less likely to be destroyed;

3. The possibility of thermal degradation with its accompanying increase in corrosiveness is reduced.

With other operating factors at their optimum, the recommended temperature will give good stripping of CO_2 and H_2S. Use of proper temperature will usually eliminate the need for costly alloys in heat exchangers and reboilers.

FOR MORE INFORMATION, look for the next Allied Chemical Contactor.

For specifications and local offices, see our insert in Chemicals Materials Catalog, pages 475-482, and in Chemical Week Buyers Guide, pages 37-44.

BASIC TO AMERICA'S PROGRESS

Allied Chemical

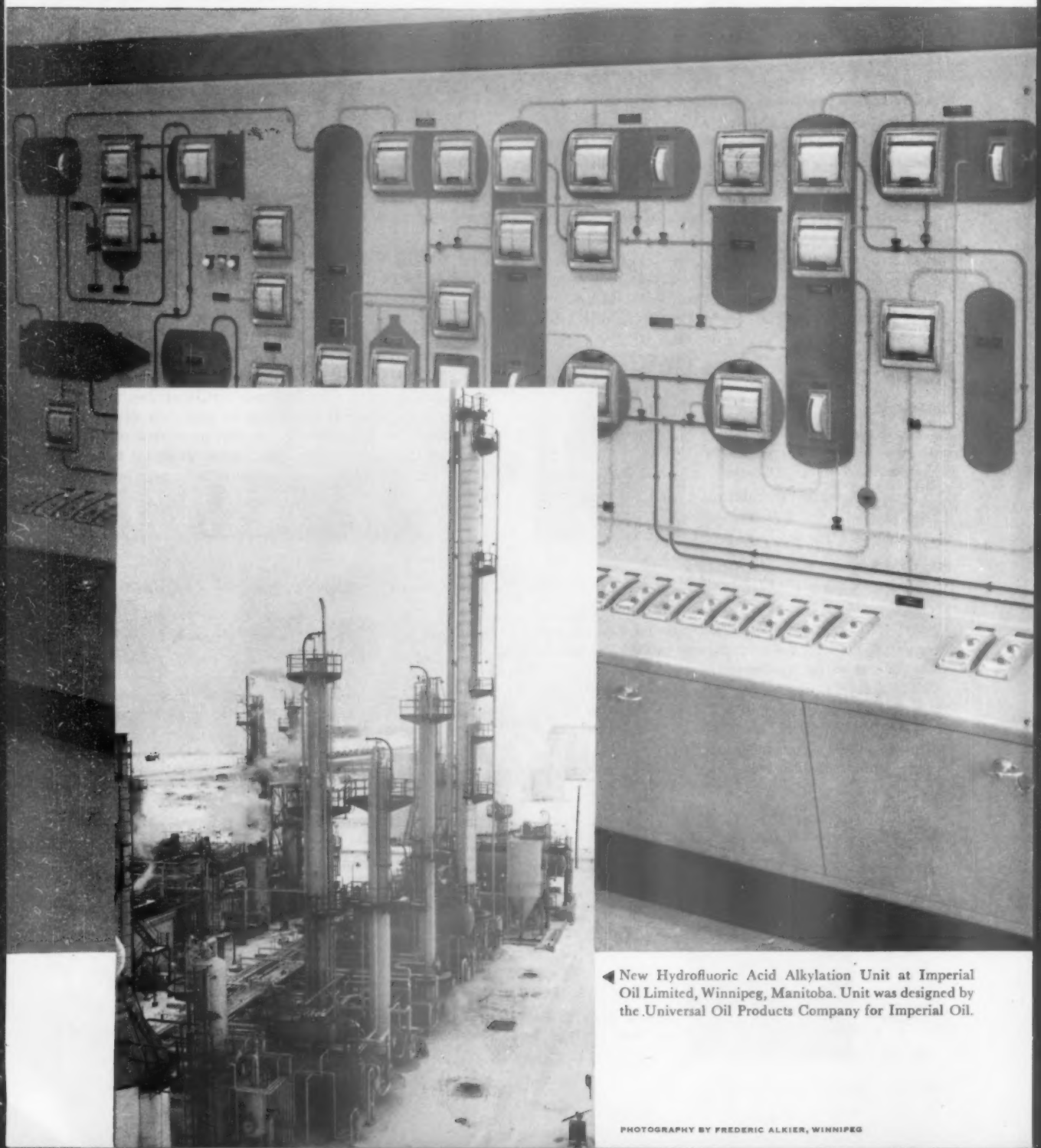
NITROGEN DIVISION

Dept. C3-55-1, 40 Rector Street • New York 6, New York

2819

at Imperial Oil Limited

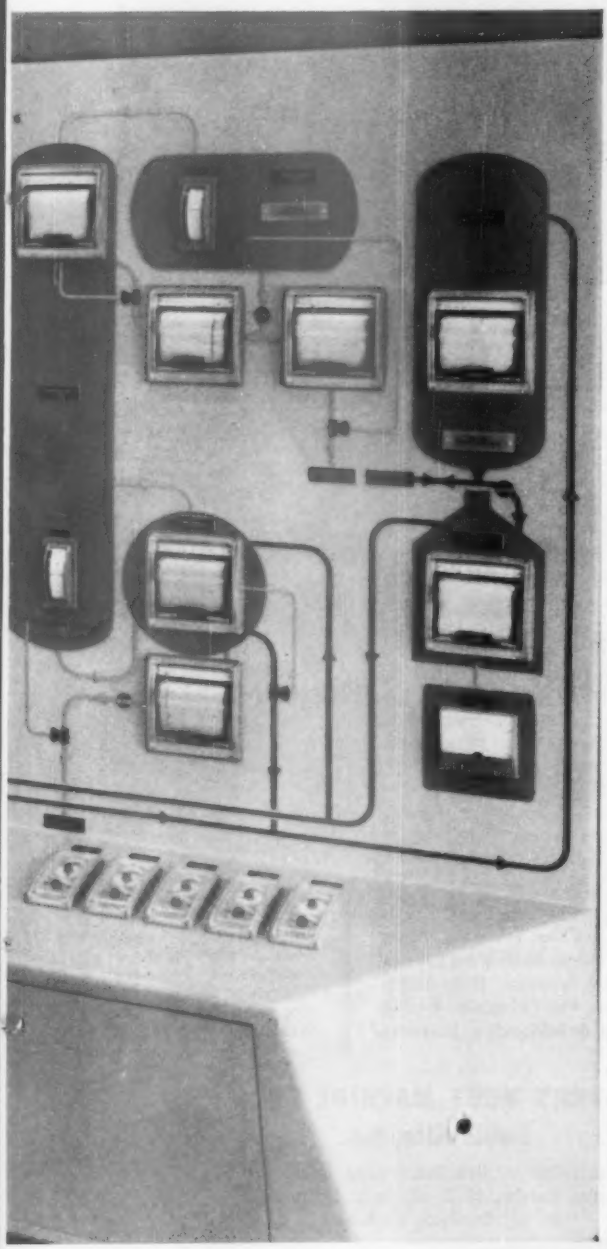
They wanted a low
they chose Foxboro



◀ New Hydrofluoric Acid Alkylation Unit at Imperial Oil Limited, Winnipeg, Manitoba. Unit was designed by the Universal Oil Products Company for Imperial Oil.

PHOTOGRAPHY BY FREDERIC ALKIER, WINNIPEG

maintenance electronic system... Electronic Consotrol instrumentation



▲ **FOXBORO ELECTRONIC CONSOTROL PANEL** at Imperial Oil includes 32 control loops. 3" x 6" Control Stations are so compact they are mounted on panel console, while recorders are mounted directly in the graphic diagram above.

problems of "frozen" air and vacuum tubes eliminated in new HF Alkylation Unit at Winnipeg, Manitoba

There were significant reasons for installing Foxboro Electronic Consotrol* Instrumentation on Imperial Oil's new HF Alkylation Unit in Winnipeg, Manitoba.

First — Foxboro electronics completely eliminated their problem of air supply — particularly vexing in a climate where the temperature drops below freezing 9 months out of the year.

And second — they like Foxboro's "all solid state" feature, because they'll never have an instrument failure due to a burned out vacuum tube.

Imperial Oil also appreciates the compactness of Foxboro electronic control panels. Compact 3" x 6" controllers are located on sloping panel console — 4-inch strip chart recorders are integrally-mounted in graphic diagram. With a minimum of searching, the operator knows how the process stands.

If speed of response, sensitivity, and reliability play an important role in your process, it will pay you to investigate Foxboro Electronic Consotrol instrumentation. Ask your Foxboro Field Engineer about it. Or write for Bulletin 21-10. The Foxboro Company, 605 Neponset Avenue, Foxboro, Massachusetts.

*Reg. U. S. Pat. Off.

FOXBORO

REG. U.S. PAT. OFF.

NOW HIGH HEAT TRANSFER RATE with LOW PRESSURE DROP

TOP: *Muddy well water is the coolant for these Jacket Water Coolers.*

RIGHT: *Two 56" Dia. x 12'0" high Amine Solution Coolers with expansion joints in shell.*

BOTTOM: *One of a number of seawater cycle units for a chemical plant. Nylon distributing ferrules prevent adherence of barnacles. Low pressure drop allows circulation of large quantity of seawater.*

Another Vogt Engineering Achievement

*One of the many distributor types developed for various applications.**

**Covered by Pat Nos. 2,057,597, 2,424,441 and others pending.*

Special metering distributors control the flow in vertical Vogt film type exchangers of single tube-pass design. The liquid is spread in a uniform film over the inside surface of the tubes. Since the liquid falls by gravity, good velocity is obtained with a small quantity of liquid.

Vogt has developed many types of distributors which are made from a variety of materials to accommodate the fluids circulated through the tubes in specific processing operations.

A unique feature of these exchangers is that the tube side can be cleaned while in operation.

Vogt Film Type Exchangers are used as Coolers, Condensers, Absorbers, Heaters, and Evaporators.

Other Vogt Products

Forged Steel Valves and Fittings. Petroleum Refinery and Chemical Plant Equipment. Steam Generators. Heat Exchangers. Ice Making & Refrigerating Equipment.

BULLETIN HE-8

Bulletin HE-8 describes unusual and standard Vogt Heat Transfer Equipment and is available upon request. Address Dept. 24A-XO.

For Direct Long Distance to Louisville
Dial: 502 [illegible] 4-9411

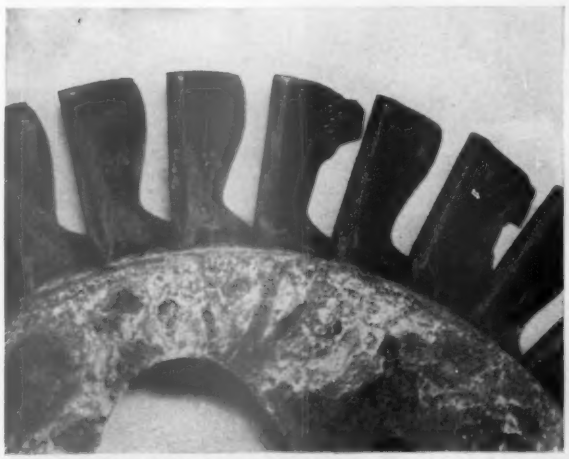
HENRY VOGT MACHINE CO.
Louisville, Ky.

SALES OFFICES: New York, Chicago, Cleveland, Dallas, Camden, N. J., St. Louis, Charleston, W. Va., Cincinnati, Los Angeles

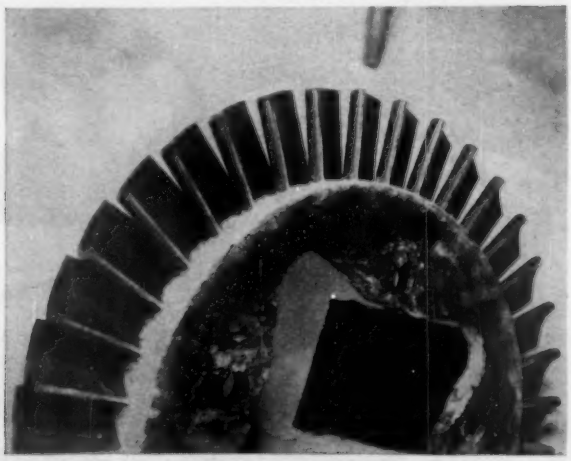
Vogt FILM-TYPE HEAT EXCHANGERS

NEW SHELL POWER RECOVERY PROCESS CUTS CRACKING COSTS

Shell now offers a way to run power recovery turbines on waste energy. The key to this process is a simple, effective fines separator that protects gas turbine blades to obtain long turbine life. Look at these unretouched photographs.



WITHOUT SHELL PROCESS – Turbine nozzle blades after only 650 hours of operation.



WITH SHELL PROCESS – After 4000 hours of operation.

The use of this Shell-designed fines separator with existing fluid-bed cat cracker regenerators permits the inexpensive expansion of carbon-burning capacity. In new systems it is capable of making substantial savings on your steam or power requirements. The process is licensed by Shell and through authorized contractors. Inquiries are invited. Shell Development Company, 50 West 50 Street, New York 20, New York.

SHELL DEVELOPMENT COMPANY

PEERLESS PUMP
INTEGRATED DESIGN
SUPERIOR DESIGN + TOP QUALITY CONSTRUCTION
+ MAXIMUM INTERCHANGEABILITY
+ OPTIMUM MATERIAL GROUPS AVAILABLE
BROADEST HYDRAULIC COVERAGE
WITH MINIMUM CUSTOMER INVENTORY
OF PUMPS AND COMPONENTS

CAN CUT YOUR PUMP INVENTORY COSTS AS MUCH AS 85%

Maximum interchangeability means far fewer parts required to fill all your day-to-day needs.

The effectiveness of integrated design of Peerless Type DL and DM process pumps can probably best be shown by a recent customer's order. This customer purchased 150 process pumps for his plant. Of the group, 120 have interchangeable parts. As a result, pump inventory of spare parts can now be cut to a fraction of former requirements freeing important dollars for many other uses. And with the greater interchangeability, the customer predicts even more savings because of speedier maintenance work and less time lost waiting for proper parts.

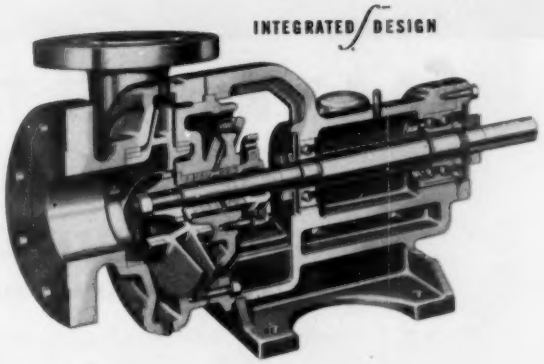
And, if interchangeability of Peerless Type DL and DM pumps captures your interest, please remember this fact. Because Type DL and DM pumps are of integrated design, you can order them out of stock just the way you need them. For example, there is a choice of semi-open or enclosed impellers; water or air cooled backplates; oil or grease lube bearing housing; packing or mechanical seals; and liquid ends of any machineable metal.

There is one more point to be told about these pumps. They are real performers. Proven time after time, they efficiently pump virtually all liquids used in the process industries.

INTEGRATED ∫ DESIGN FOR GREATER EFFICIENCY AND SAVINGS

PEERLESS PUMPS

INTEGRATED ∫ DESIGN



VERSATILE IS THE WORD FOR THIS PEERLESS DL—DM PROCESS PUMP

The Peerless Type DL and Type DM process pumps will handle virtually all liquids used in the chemical, process and refining industries. Both models are single stage, single suction centrifugal types with a vertically split case, and both models have capacities to 1000 gpm, heads to 430 feet and working pressures to 300 psig. Type DL models have a temperature range of 250°F, while the Type DM models have a range of 450°F.

FOR EXAMPLE: WITHIN FIVE DIFFERENT SIZE PUMPS THESE 22 PARTS ARE INTERCHANGEABLE—

1. Shaft
2. Back plate
3. Packing rings
4. Radial bearing
5. Packing gland
6. Thrust bearing
7. Pump frame
8. Impeller lock nut
9. Bearing lock nut
10. Seal lantern packing
11. Key
12. Thrust plate
13. Water slinger & set screw
14. Lockwasher-bearing
15. Gasket-volute case
16. Gasket-thrust plate
17. Oil retainer plate
18. Oiler: constant level
19. Lockwasher-impeller
20. Gland clamp
21. Splash plate
22. Retaining ring bearing

Putting Ideas to Work

fmc FOOD MACHINERY AND CHEMICAL CORPORATION

Peerless Pump HYDRODYNAMICS DIVISION

Offices:
New York; Detroit; Cleveland; Chicago; Indianapolis; St. Louis; San Francisco; Atlanta; Plainview; Lubbock; Phoenix; Albuquerque; Los Angeles; Fresno.

Distributors in principal cities.
Consult your telephone directory.

Peerless Pump, Hydrodynamics Division, Food Machinery & Chem. Corp.
301 West Avenue 26, Los Angeles 31, California

Send me Bulletin B-1608 ☐ Have field engineer contact me ☐

Company_____

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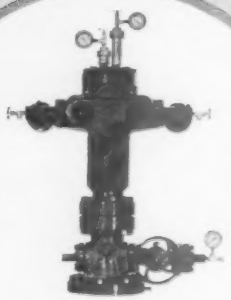
O&GJ

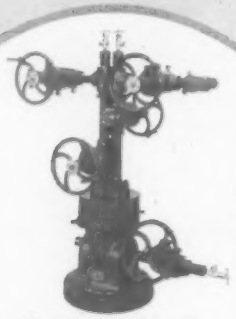
O·C·T HAS THE RIGHT EQUIPMENT FOR LOW PRESSURES, HIGH PRESSURES or any pressure in between.....

ASK THE O·C·T REPRESENTATIVE NEAREST YOU ABOUT A NEW SERIES OF LOW PRESSURE EQUIPMENT

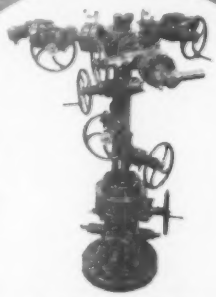
Triple Block Tree



Dual Unitree

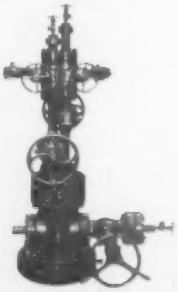


Threaded dual tree with Crescent Flange Bottom

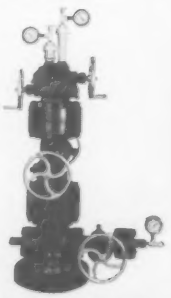


Triple Tri-Flange Tree

Single Unitree



Crescent Flange Tree with Crescent Flow Controls



Dual Hookup with Dual Controls

where progress is a daily practice

O·C·T

OIL CENTER TOOL CO.

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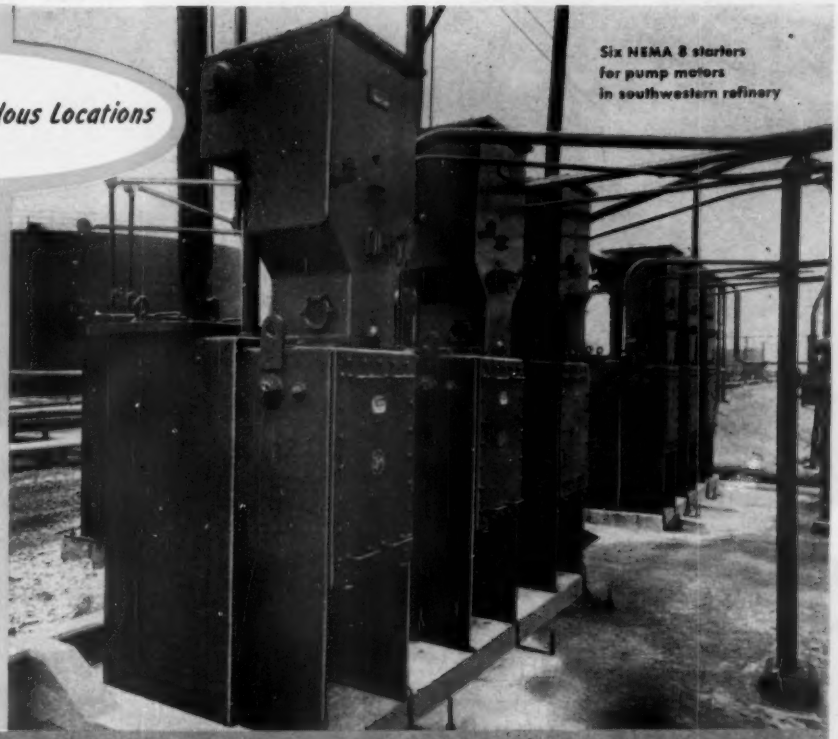
for Class 1, Group D, Hazardous Locations

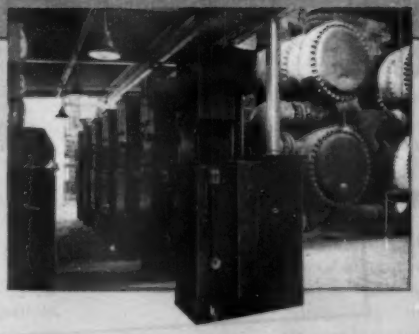


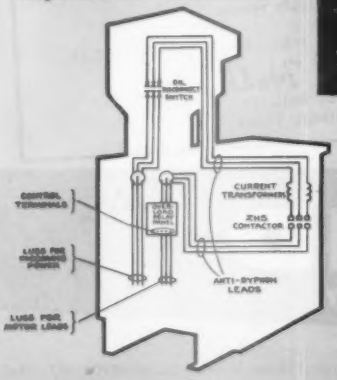
Six NEMA 8 starters for pump motors in southwestern refinery

here's how to

SAVE SPACE and INSTALLATION TIME with EC&M HIGH VOLTAGE STARTERS

SPACE SAVERS! Each of the seven starters in the eastern refinery installation *(at the right)* requires a space of only 2 ft. x 4 ft.—permitting close grouping with maximum accessibility for inspection and maintenance.





YOU SAVE INSTALLATION TIME because every EC&M starter is shipped with all internal wiring complete. *(See diagram at left)* All leads are of anti-syphon construction.

***Write* for Bulletin 8131 AM**

These EC&M 2200-4800 volt Starters are designed for use where hazardous mixtures of air and inflammable gases or vapors are ever-present. NEMA 3R (raintight) enclosure permits mounting indoors, outdoors, or in semi-enclosed location. Load-break oil disconnect switch is self-contained and completely wired into the starter.

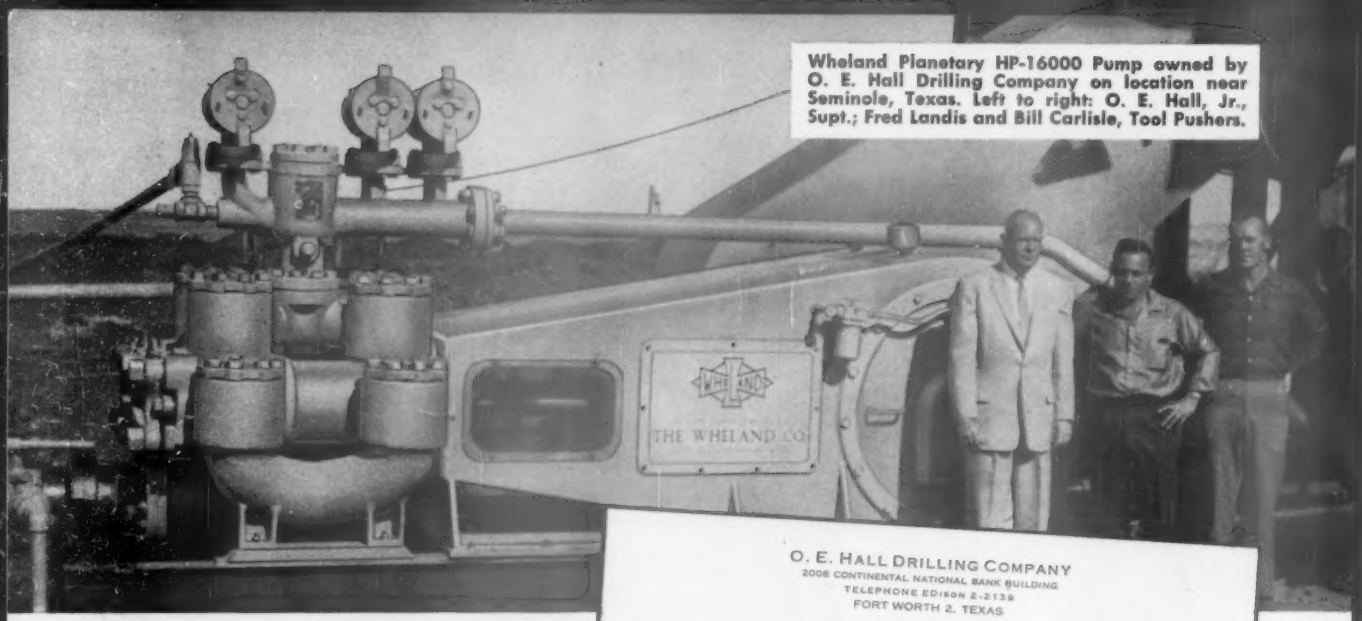
Available in two ratings for any power capacity. (*1*) 50,000 KVA (certified) interrupting capacity of EC&M Type ZHS Contactor. (*2*) In VALIMITOR® (volt-ampere-limitor) style... the bus may be of unlimited capacity.

SQUARE D COMPANY

EC&M DIVISION • CLEVELAND 28, OHIO

wherever electricity is distributed and controlled

7026



Wheland Planetary HP-16000 Pump owned by O. E. Hall Drilling Company on location near Seminole, Texas. Left to right: O. E. Hall, Jr., Supt.; Fred Landis and Bill Carlisle, Tool Pushers.

"... the pump has improved our operation ...we will be happy to recommend it."

O. E. HALL, Jr.

WHELAND PLANETARY HP-16000 PUMP

Duplex Power Slush Pump

7¾"x16", 600 HP at 65 RPM

O. E. HALL DRILLING COMPANY
2008 CONTINENTAL NATIONAL BANK BUILDING
TELEPHONE EDISON 2-2139
FORT WORTH 2, TEXAS

February 16, 1960

The Wheland Company
Signal Mountain Road
Chattanooga, Tennessee

Mr. Gordon L. Smith, Jr.
Manager Rotary Drilling Equipment Sales

Dear Mr. Smith:

We thought you would be interested to know how pleased we are with the performance of our Wheland Planetary HP-16000 Pump. It is the smoothest running pump we have seen. The big gear reduction makes possible such a small sheave and the pump pulls very easily. We are also impressed by the compactness of the gear cartridge and the smooth performance of the new circular crosshead. In the several wells we have drilled thus far the pump has improved our operation in terms of penetration rate and savings in bits. Also has exceeded our expectations.

All of these wells have been located in West Texas. We operate our rigs throughout the Permian Basin covering a depth range of 4, 500 feet to 12, 500 feet with modern equipment.

We want to commend The Wheland Company for stepping forward with this improved design in slush pumps, and we will be happy to recommend it.

Very truly yours,

O. E. HALL DRILLING COMPANY
O. E. Hall Jr.
O. E. Hall, Jr.
Midland, Texas

WHELAND

ROTARY DRILLING MACHINERY

THE WHELAND COMPANY
CHATTANOOGA, TENNESSEE, U.S.A.

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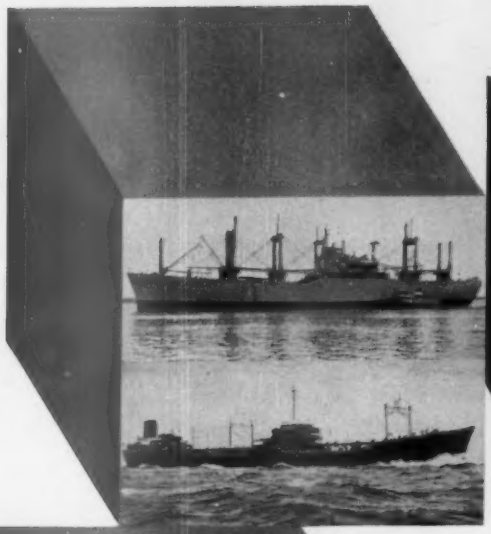
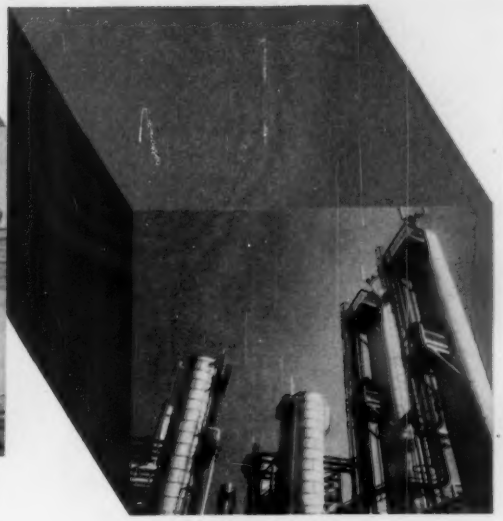
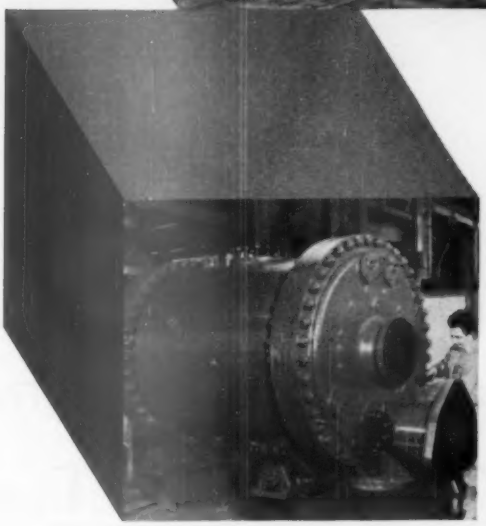
EXPORT DISTRIBUTORS: LUCEY EXPORT CORPORATION—233 Broadway, New York 7, New York—Broad Street House, London, E. C. 2, England.







SUN SHIP built 'em all....

Our reputation as "master builders for land and sea" is based on 44 years' service to the oil-refining, chemical and other industries.

Frequently we are called upon to produce components for the building of large plants. Our manufacturing and fabricating skills, our understanding of industry's problems are reflected in the variety of equipment we build, like the fractionating towers and special pressure vessel shown here.

In our complete, modern shops we build and *deliver* what's needed in many fields. Our special Alloy Products Shop, for example, is equipped to produce medium and heavy stainless alloy and aluminum products for industry.

Building for land • Pressure vessels • Fractionating towers • Stills and tanks • Condensers and similar equipment • Special machinery • Plate work, etc.

Building for sea • Dry cargo ships • Tankers • Marine repairs • Dredges • Ferries • Marine engines • Marine machinery.

Sun Ship does a big job for many companies, and can do the same for you.

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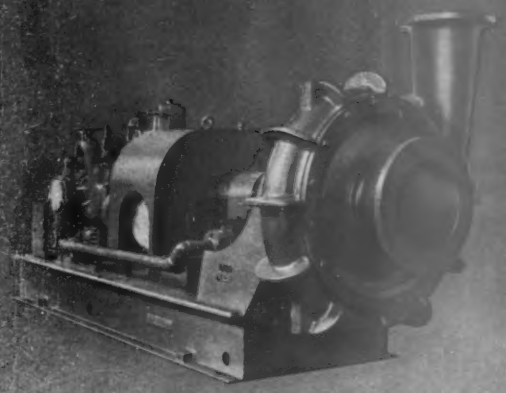
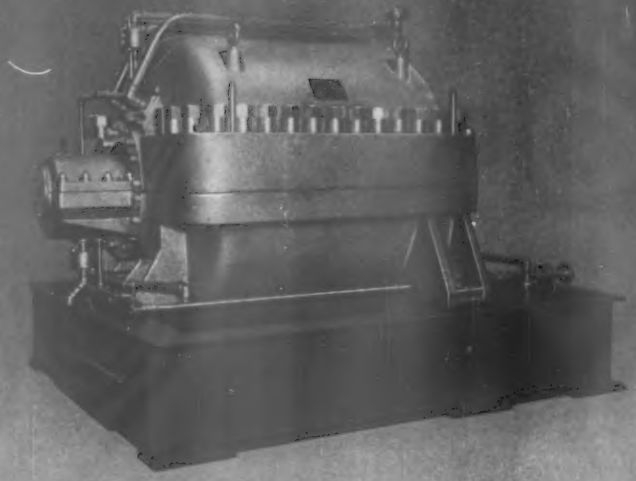
MOST COMPLETE



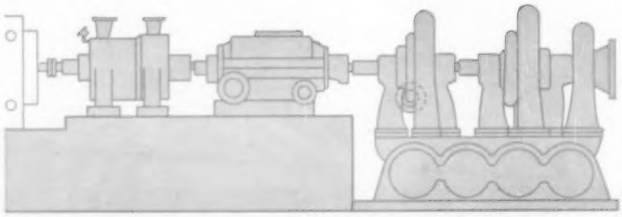
Single-Stage Compressors — Fabricated and cast construction for discharge pressures as high as 1000 psi and for capacities to 700,000 cfm.*



Multi-Stage Compressors with horizontally split casings for discharge pressures to 600 psig; capacities as high as 200,000 cfm.* (driver not shown)

That's why Ingersoll-Rand

ANYTHING YOU WANT in a



▲ Three different types of I-R multi-stage compressors comprise this unit which handles 15,900 cfm with a final discharge pressure of 805 psig. All are gear driven from a single steam turbine.

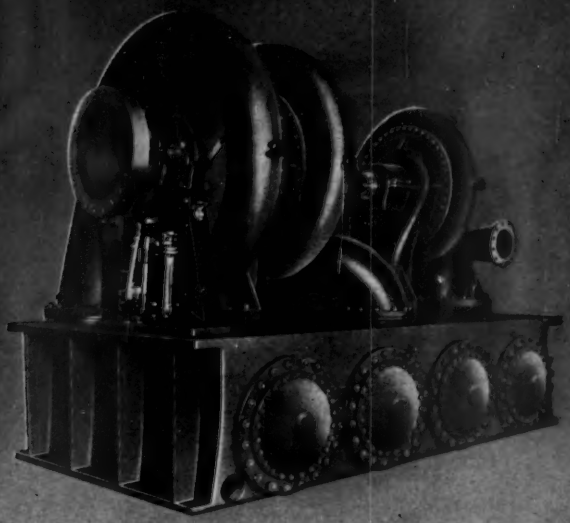
What does your process require in a centrifugal compressor—single stage, multi-stage, vertically-split, horizontally-split, top-connected or bottom connected? Whatever design meets your requirements to best advantage, you can get it from Ingersoll-Rand. That's because Ingersoll-Rand offers the most complete line of centrifugal compressors available from any single manufacturer—more types, more sizes, more optional arrangements and combinations.

This extra flexibility of design enables you to meet your exact requirements most easily and economically, with maximum utilization of *standard* proven components and minimum "special" engineering.

For example, the apparently highly specialized multiple-unit machines shown at the right are made up of standard compressor units selected and arranged to meet specific operating and installation requirements for actual installations.

For further information on the centrifugals best suited to your requirements, contact your I-R compressor specialist. His experience in process compression can save you time, effort and expense, from initial design to final installation and operation.

Multi-Stage Compressors with vertically split casings for discharge pressures to 5500 psi and higher; capacities to 20,000 cfm.*

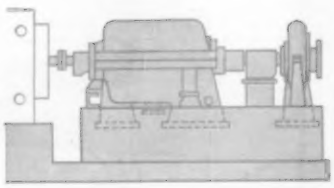


Intercooled 100 psi Compressor, for large capacity air requirements, approaches the ideal isothermal design (driver not shown).

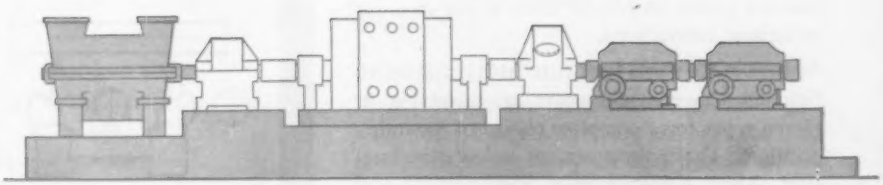
* *Ratings shown cover existing designs and do not represent limits of I-R Centrifugal Compressors. If your particular application falls outside of the ranges shown, we would welcome the opportunity to discuss it with you.*

can give you

centrifugal compressor



▲ The high-ratio single-stage compressor reduces initial volume to the multi-stage compressor sufficiently to keep final stage volume within the capabilities of standard 52″ impellers thereby eliminating a specially constructed single-casing unit.



▲ Three horizontally split compressors are used in this installation which features a single driver with two speed increasers to match the customer's operating requirements.

Ingersoll-Rand

119A12 **11 Broadway, New York 4, N. Y.**

PUMPS · CENTRIFUGAL & RECIPROCATING COMPRESSORS · DIESEL ENGINES · AIR & ELECTRIC TOOLS · TURBO BLOWERS · STEAM CONDENSERS

Only Grinnell has a complete line of pipe

With 8 . . . 9 . . . even 10 inches of thermal movement not a bit unusual in today's high temperature piping systems, complete support for piping in all positions of travel is vital.

SAFETY OF ENTIRE SYSTEM AT STAKE

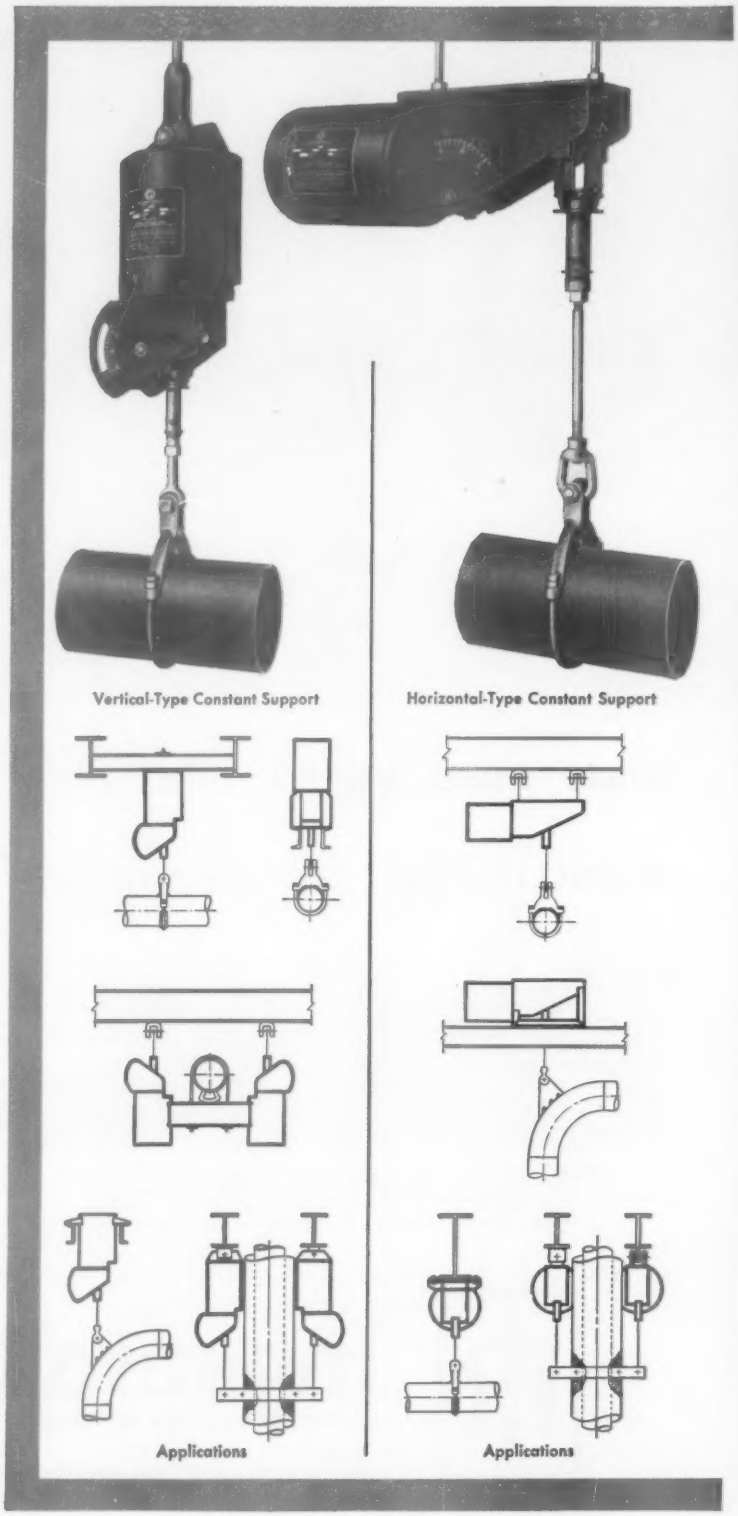
Helical coil springs are widely used to provide for thermal expansion. But the design or selection of flexible supports often is haphazard. Unless careful study is given to the design and choice of spring supports, the transfer of weight from one hanger to another, or from hanger to terminal points, can endanger the safety factor of the entire system.

MATHEMATICALLY PERFECT GRINNELL CONSTANT SUPPORTS

Grinnell Constant Supports are the result of a century of experience in the industrial piping field. A patented geometric design, exclusive with Grinnell Constant Supports, assures mathematically perfect load support throughout all positions of travel. There is also a full 70 percentage points of adjustability built into them. No less than 10 percent of this adjustability is allowed either side of calibration for plus or minus change in load. Field readjustments are easily made by turning a single load adjustment bolt. These hangers are designed to provide uniform supporting force equal to the pipe load throughout the travel range — and should be used at selected points on critical lines, as for example at turbine connections.

Available in 11 Different Types

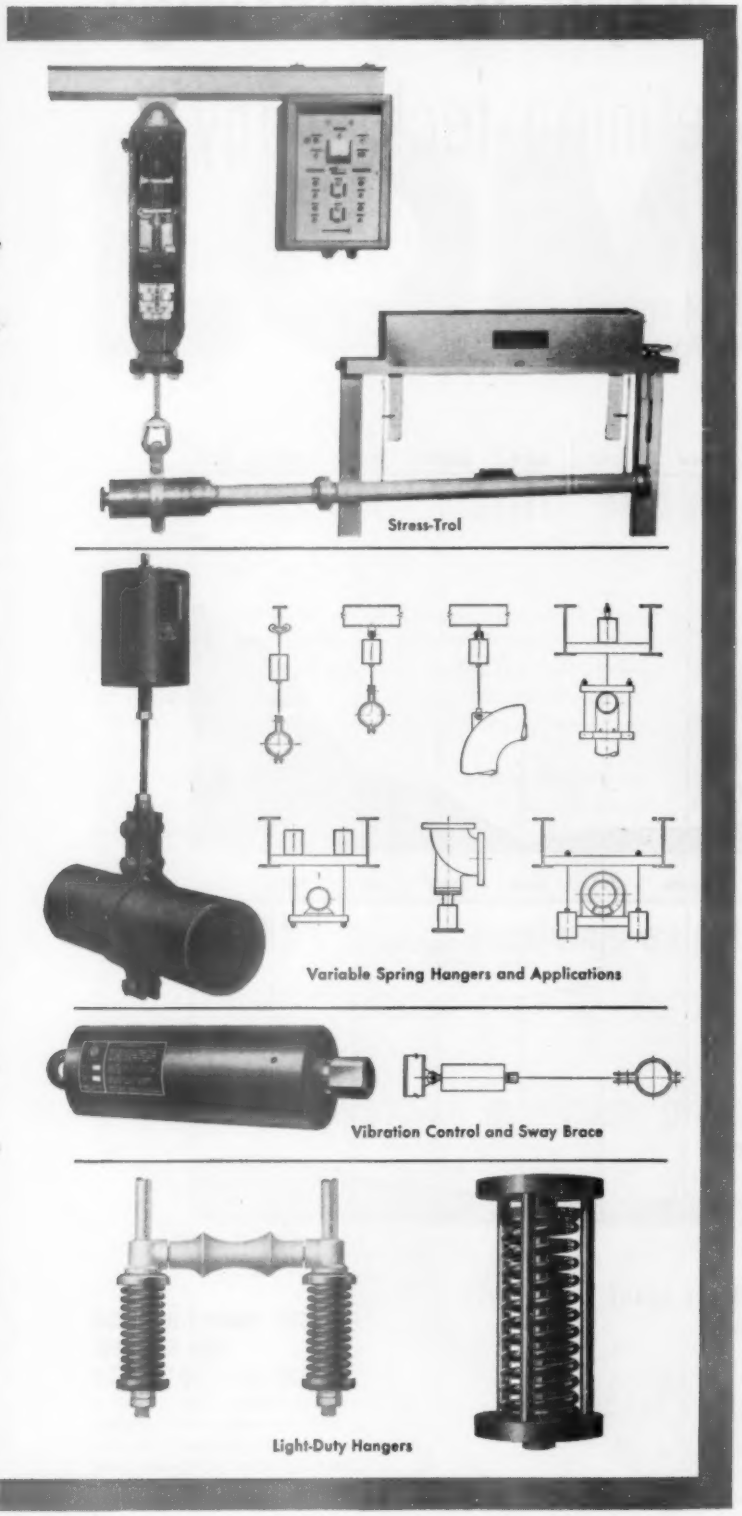
Grinnell Constant Supports are available in eleven types for a complete choice of mounting positions; above, between, or below structural steel. This choice includes both vertical and horizontal design to fit compactly into available headroom space. Even with this wide choice, Grinnell Constant Support Hangers provide mathematically perfect support through *all* ranges of travel, regardless of field adjustments.



GRINNELL

AMERICA'S No. 1 SUPPLIER OF PIPE HANGERS AND SUPPORTS

hangers to provide for thermal expansion



GRINNELL STRESS-TROL* FOR POSITION AND/OR LOAD CONTROL

Keeping the footage of high pressure-high temperature fabricated piping to a minimum has become important because of high piping costs. This can be accomplished by reducing the length of long expansion bends, but providing support for shorter, less flexible lengths of piping presents a new problem. Grinnell Stress-Trol, a motor operated device, solves this problem. It provides:

Position Control — that minimizes stresses in piping and reactions on connected equipment.

Load Control — that is constant support with unlimited load and travel capacities.

GRINNELL VARIABLE SPRING HANGERS

When pipe lines are subject to relatively small vertical movement, and do not require a constant support type hanger, Grinnell Variable Spring Hangers are available. The maximum variation in supporting force for standard spring models per ½ inch deflection is 10% of rated capacity. Grinnell offers these hangers in 21 sizes — in short, standard and double spring models, plus a special corrosion-resistant model. There are 7 different methods of attachment.

GRINNELL VIBRATION CONTROL AND SWAY BRACE

When necessary to prevent undesirable movement in lines, Grinnell Vibration Controls and Sway Braces of the energy storing and instant-acting counter force type are recommended. They dampen vibration, oppose pipe sway and absorb shock.

GRINNELL LIGHT-DUTY SPRING HANGERS

Finally, simple and inexpensive adjustable light-duty spring hangers often are all that's required to support piping safely. Grinnell has a complete line of light-duty hangers. They are designed for easy installation and quick, accurate alignment of piping.

Whatever your pipe suspension needs, Grinnell can supply them. Grinnell Company, 260 West Exchange Street, Providence 1, Rhode Island.

Patents Applied For

GRINNELL

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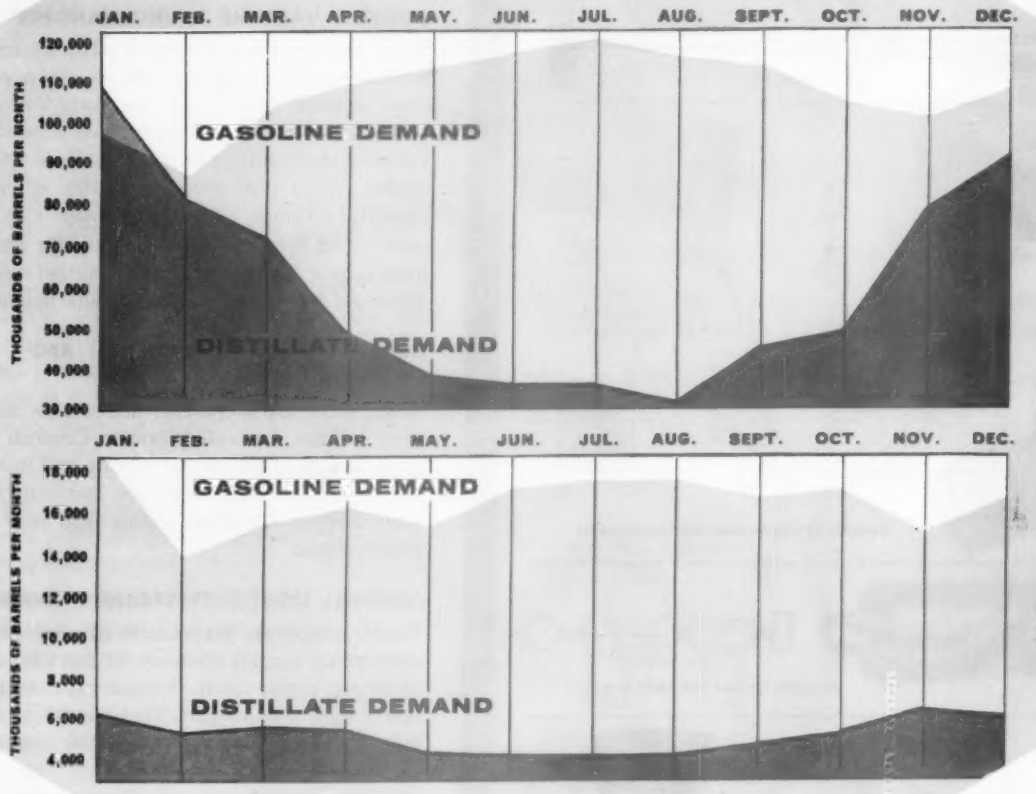
now...**a major breakthrough** in petroleum refining technology...



CHANGING MARKET DEMANDS FOR GASOLINE AND LIGHT DISTILLATES

Chart shows the necessity for adjusting refinery operations to produce varying proportions of gasoline and light distillates, a job done most efficiently and profitably by LOMAX.

LOMAX

TRADEMARK

the versatile **new UOP** process

Here is a new and vastly important process to which every refiner should give serious consideration—now! Regardless of present markets and whether existing facilities are old or up-to-the-minute, LOMAX may prove economically attractive through *increased year-'round production of your most saleable products.*

Through the reaction of oil with hydrogen in the presence of a new UOP catalyst, LOMAX converts middle distillates, ranging from kerosines to heavy gas oils, into a wide ratio of gasoline or distillate fuels. This highly flexible process may be used to supplement existing facilities, or as a basic cracking operation in a new installation.

Advantages offered by LOMAX also include: Predominance of branched isomers in light hydrocarbons . . . greatly reduced quantities of light gases . . . olefin-free products . . . no catalyst deposit . . . distillates of exceptional high purity (even from sour crudes) . . . and other important benefits.

- **LOMAX** produces **maximum saleable product**...up to 120 barrels of product from 100 barrels of charge stock.

- **LOMAX** gives you **maximum production** of the product you want when you want it...whether gasoline or light distillates.

UOP®

Write for detailed technical information. Address:

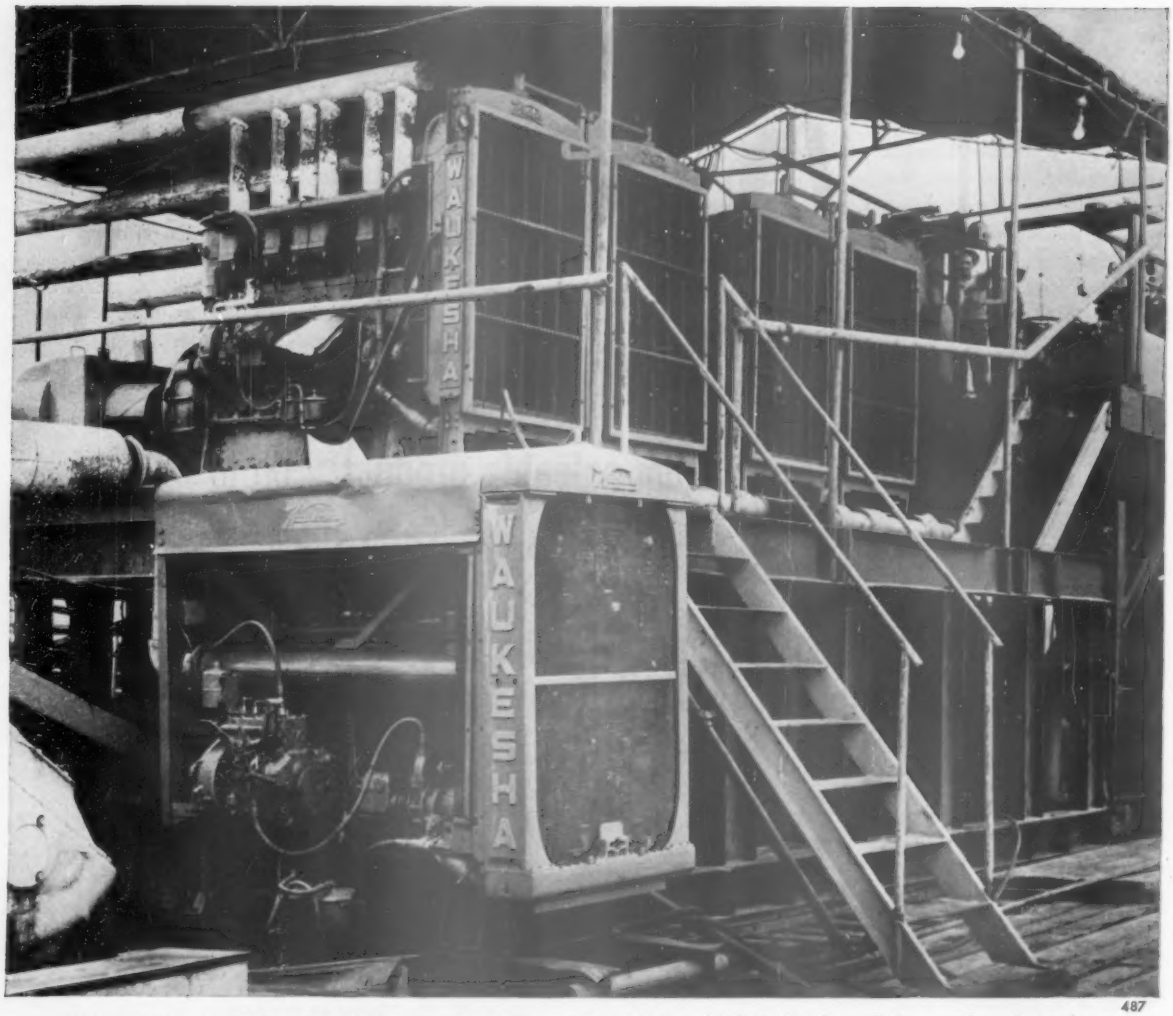
UNIVERSAL OIL PRODUCTS COMPANY

30 Algonquin Road, Des Plaines, Illinois, U. S. A.

WHERE RESEARCH TODAY
MEANS PROGRESS TOMORROW

WAUKESHAS ...here and everywhere in the oil fields

The STANDOUTS—in any oil field, on any job—are always Waukeshas! Here, for instance—at Groves, Texas (near Beaumont) on Rig 4 of the Meredith Drilling Co. of Houston, Texas—are four 1905 cu. in., 7 x 8¼-in. NKRBU Waukesha gas power units on the platform; and down below a 1197 cu. in., 6¼ x 6½-in. WAKU Waukesha gas power unit. The driller, H. E. Offutt says these Waukeshas have worked constantly for years with no major repairs. It's that way *all over the oil fields.* Reliability is only one big reason why Waukeshas dominate. Diesel, LPG, natural gas, gasoline—to 1235 hp. Get Bulletin 1079.



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WAUKESHA MOTOR COMPANY, WAUKESHA, WISCONSIN / **New York • Tulsa • Los Angeles**
Factories: Waukesha, Wisconsin and Clinton, Iowa

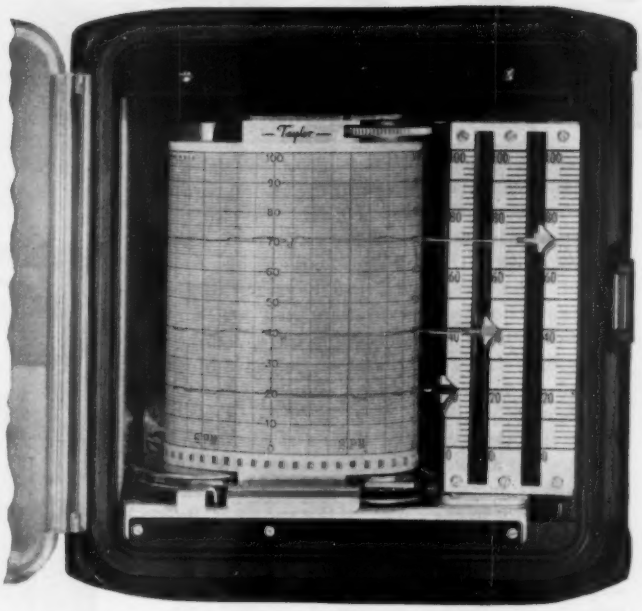
PERFORMANCE OUTSTANDING

Taylor Electronic 1, 2 or 3 Pen Recorder

HERE'S WHY:

- Takes any standard DC transmission input signals, e. g. 1-5 ma, 4-20 ma, 10-50 ma.
- Linear signal is recorded on rectilinear coordinates, reading left to right. Hundreds of standard charts.
- Uses DC voltages, minus 0.5 to +0.5, 0 to 1, 0.25 to 1.25 v. or any other DC voltage that can work into an impedance of 20,000 ohms per volt.
- Standard accuracy 0.5%. Optional, 0.25%. Accuracy unaffected by line voltage changes ±10%.
- Threshold sensitivity 0.1%.
- Speed of response excellent—full scale travel in less than ¾ second.
- Recorder pen can be quickly calibrated without even unplugging recorder slide.

All these advantages are made possible by use of an actual true 2-phase servo motor, coupled with a high-gain transistorized amplifier, standardized by Zener Diode voltage reference.



Available as a recording (700J) or indicating (701J-704R) control station, it also gives you these features: fastest response; bumpless capacitor gain switching; automatic stabilization during transfer; widest range of adjustments; multiple valve operation; elimination of overpeaking.

Team up the 700J or 701J with a Taylor electronic transmitter—for temperature, pressure or differential pressure.

Ask your Taylor Field Engineer for full details, or write for **Catalog 98335.** Taylor Instrument Companies, Rochester, N. Y., or Toronto, Ont.

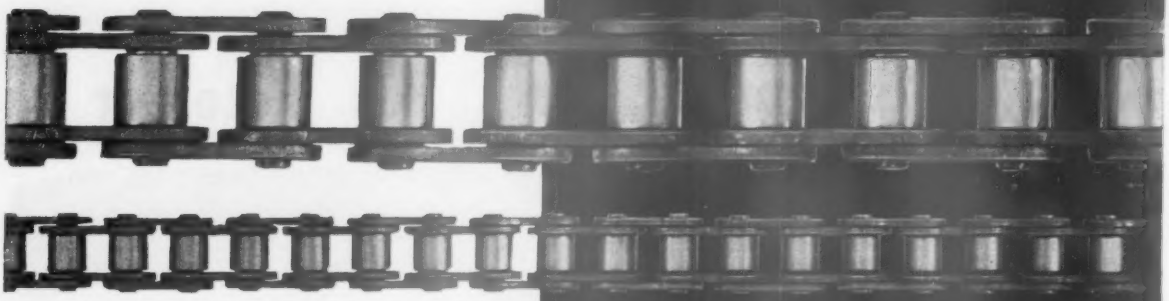
Optional Features Available . . .

- Heavy-duty alarm contacts, 5 amps, 120 v. AC.
- 2-speed chart drive with flip of a switch. Any combination of 2, 4, 6, 9, 12, 15, 18 and 30" per hr.; 1, 3 and 6" per min.
- Retransmitting slide wire. (eg. for multiplication, square root extraction.)
- Will handle mv signals, 0-3 to 0-50, with 700T Pre-Amplifier.
- 24 hr. Adjust-O-Matic tear-off chart.

Taylor Instruments **MEAN ACCURACY FIRST**

Tests point way to efficient high-speed drives

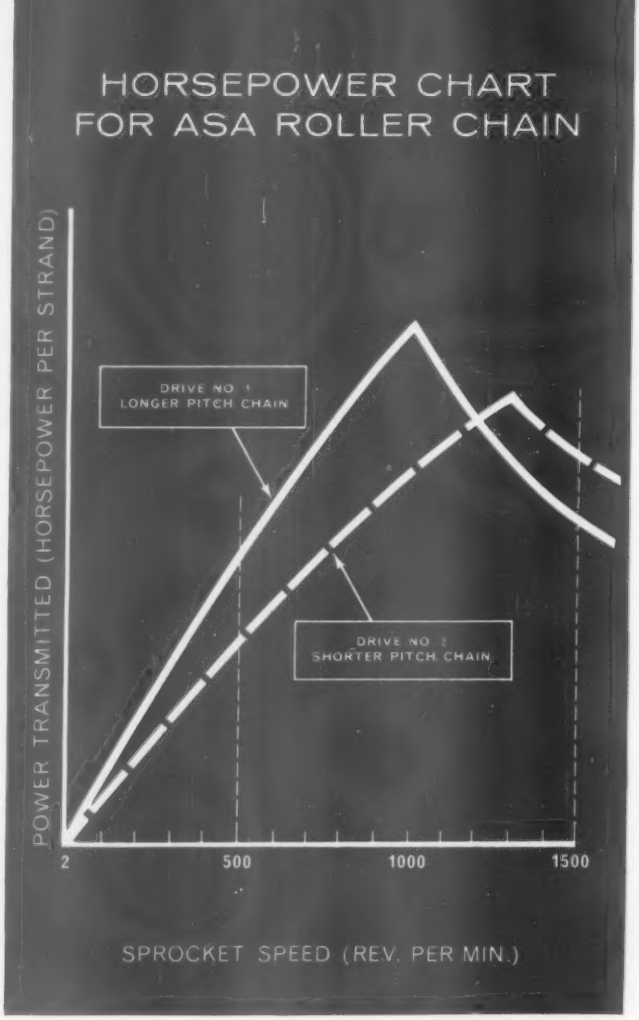
the BIG PLUS value



In many chain drive applications, machine designers are seeking more efficient ways to handle higher speeds and greater horsepower. Foreseeing this trend, CHAIN Belt engineers began an intensive program of research into the effects of greater speeds and horsepower on chain life.

Thousands of hours' testing gave definite evidence that new concepts of chain selection were needed in the higher speed ranges. *Shorter* pitch chains were proved to have more horsepower capacity than longer pitch chains at higher speeds. As the chart above shows, the horsepower capacity of a given pitch chain increases to a peak at a definite point in the r.p.m. of the sprocket. Beyond this point, the h.p. capacity of the bushing and roller decreases. But this point is higher for the shorter pitch chain than for the longer. The heavier link plates in the longer pitch chain (Drive No. 1) enable it to handle a greater load at 500 r.p.m. than the shorter pitch chain. At 1500 r.p.m., the shorter pitch chain handles a much heavier load.

In any given application, there is an optimum pitch and sprocket size that should be used. CHAIN Belt engineers, through their testing program, have made determinations that assure the right choice of chain for each service. If you have a problem involving higher speed power transmission, we suggest you write CHAIN Belt Company, 4619 W. Greenfield Avenue, Milwaukee 1, Wis.



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CHAIN BELT COMPANY

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another

TRETOLITE SERVICE report

Midwestern refinery "saves a bundle" with KONTOL* *Corrosion Inhibitor*

Both ways—in dollars and in actual equipment—this refinery "saved a bundle" in its crude unit heat exchange section by adopting a KONTOL* protection program.

Heat exchange was inefficient and tube life was short. Then KONTOL Corrosion Inhibitor was injected into the overhead line ahead of the condensers.

Here are the bundle-saving results:

- Tube bundle life was *tripled* by drastic curtailment of corrosion.
- Heat savings amounted to *6,000,000 BTU's per hour*, as a result of KONTOL's powerful detergent action.
- Estimated cost of heat loss was $96 per day prior to use of KONTOL. KONTOL protection eliminated this loss for only $20 per day—a savings of nearly 5 times the cost.

KONTOL Corrosion Inhibitors are protecting tube bundles, and saving bundles of money, for refiners all over the world. Ask your Tretolite Field Service Engineer (the "Man in the Red Car") for more details.

*Registered trademark of Petrolite Corporation

KR-60-5

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This is Why the Nash is the Most Simple Compressor

It's the Nash!

There are no mechanical complications in a Nash Compressor. A single moving element, a round rotor, with shrouded blades, forming a series of buckets, revolves freely in an elliptical casing containing any low viscosity liquid. This liquid, carried with the rotor, follows the elliptical contour of the casing.

The moving liquid therefore recedes from the rotor buckets at the wide part of the ellipse, permitting the buckets to fill with gas from the stationary Inlet Ports. As the casing narrows, the liquid is forced back into the rotor buckets, compressing the gas, and delivering it through the fixed Outlet Ports.

Nash Compressors produce 75 lbs pressure in a single stage, with capacities to 6 million cu. ft. per day in a single structure. Since compression is secured by an entirely different principle, gas pumping problems difficult with ordinary pumps are often handled easily in a Nash.

Nash simplicity means low maintenance cost, with original pump performance constant over long periods Data on these pumps sent immediately on request

- No internal wearing parts.
- No valves, pistons, or vanes.
- No internal lubrication.
- Low maintenance cost.
- Saves floor space.
- Desired delivery temperature automatically maintained.
- Slugs of liquid entering pump will do no harm.
- 75 pounds in a single stage.

NASH ENGINEERING COMPANY
313 WILSON, SO. NORWALK, CONN.

for storage of refrigerated gases...

PROPANE -42°C

ETHYLENE -104°C

METHANE -161°C

OXYGEN -183°C

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EXPERIENCED BUILDERS OF
STORAGE FACILITIES
FOR REFRIGERATED GASES

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CHWR/W/135

Better products, *faster,* from your Bower Distributor:

Bower Roller Bearings keep slim-hole rigs mobile and more competitive, too!

You can depend on Bower bearing refinements to minimize friction and keep rigs rolling!

In profitable slim-hole drilling operations, rigs roll safely and swiftly on Bower Spher-O-Honed tapered roller bearings.

That is why it is best to replace any worn bearings from the line most used by leading equipment builders. Built-in qualities of Bower bearings include extra-large flanges for more durability . . . larger oil grooves for better lubricant circulation . . . smoother contact and shoulder radius design. These combine to put Bower bearings *out front* in delivering big tonnage with unequalled dependability.

Your Bower Bearing Distributor assures you of fast delivery in tapered or straight roller bearings. Call him to fill your next replacement need.

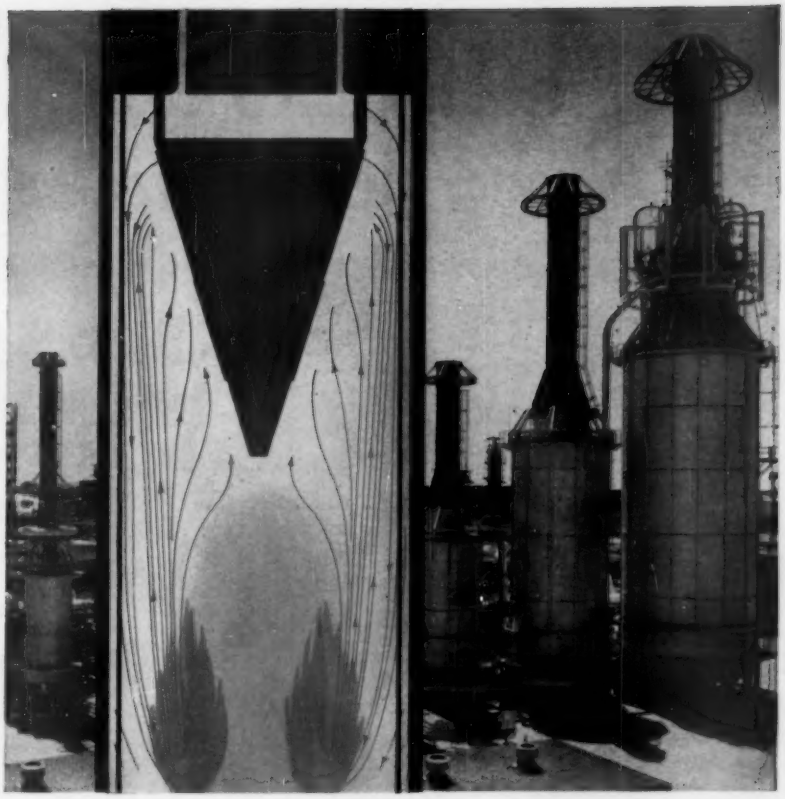
BOWER ROLLER BEARINGS

FEDERAL-MOGUL SERVICE

DIVISION OF FEDERAL-MOGUL-BOWER BEARINGS, INC. • DETROIT 13, MICHIGAN

BEARING BOWER ROLLER BEARINGS SERVICE

PUTTING THE HEAT ON EVENLY EFFICIENTLY



Petrochem Isoflow Furnaces give even heat distribution—with added convection sections for maximum fuel efficiency

This is the heart of Petrochem Isoflow Furnaces—the furnaces that get more heat from every measure of fuel. Only Petrochem incorporates all three critical design features so important to highest efficiency in fired heaters: 1) burners specifically designed to furnace needs, 2) properly engineered firebox proportions, and 3) reradiation cones. These factors add up to a more even heat distribution and maximum heat efficiency. Even greater heat efficiency for certain heater applications can be obtained with Petrochem's added convection sections.

Cleaning is easier than with ordinary horizontal-type heaters. Only 25 per cent of the space normally needed is required to pull the tubes of a Petrochem furnace. When specifying furnaces—remember, *there are more Petrochem Isoflow Furnaces in service today than any other make.*

YUBA

specialists in process furnaces for every size, capacity and duty

PETROCHEM DEVELOPMENT DIVISION
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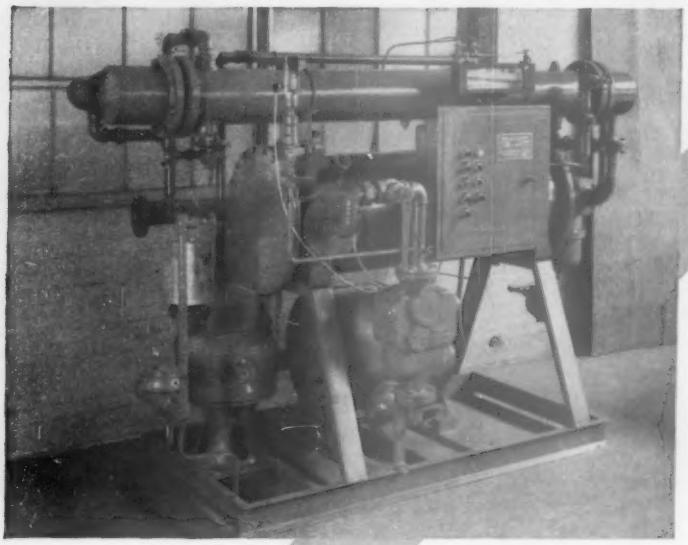
KEMP INERT GAS GENERATORS

give you 4 basic advantages!



FOR BLANKETING
AGITATING
O_2 EXCLUSION
PURGING
FIRE AND
EXPLOSION
ATMOSPHERES

1 **Constant analysis** is automatic due to the exclusive Kemp Carburetor that pre-mixes gas and air in precisely the ratio you desire . . . maintains it regardless of total demand or pressure fluctuation in the supply line.

2 **Easy start-up** is yours with Kemp Carburetor and external test burner. You test the pre-mixed gas-air ratio *before* it enters the combustion chamber. And electric ignition gets your Kemp Generator off to a time-saving, labor-saving start.

3 **Safety controls** effectively end flame-out danger. Kemp's electronic flame failure control instantly and automatically cuts off gas supply to the carburetor. Moisture and combustion chamber pressure cannot affect this control.

4 **Set it—forget it.** Once you've set the vernier dial on your Kemp Generator you can walk away and forget about it. Kemp's exclusive carburetor keeps your exact gas-air ratio coming hour after hour —as long as you wish—without further checking or manipulation of controls.

SEE THE MAN FROM KEMP

He is equipped and qualified to advise you on any size and type of generator you may require . . . can also counsel you on dryers and compressors for inert or nitrogen generation systems and heaters. See your C.E.C. Catalog for full listing of Kemp representatives in your area or check your local telephone book. For details on Kemp Inert Gas Generators, write for Bulletin I-10.

It always pays to come to

KEMP
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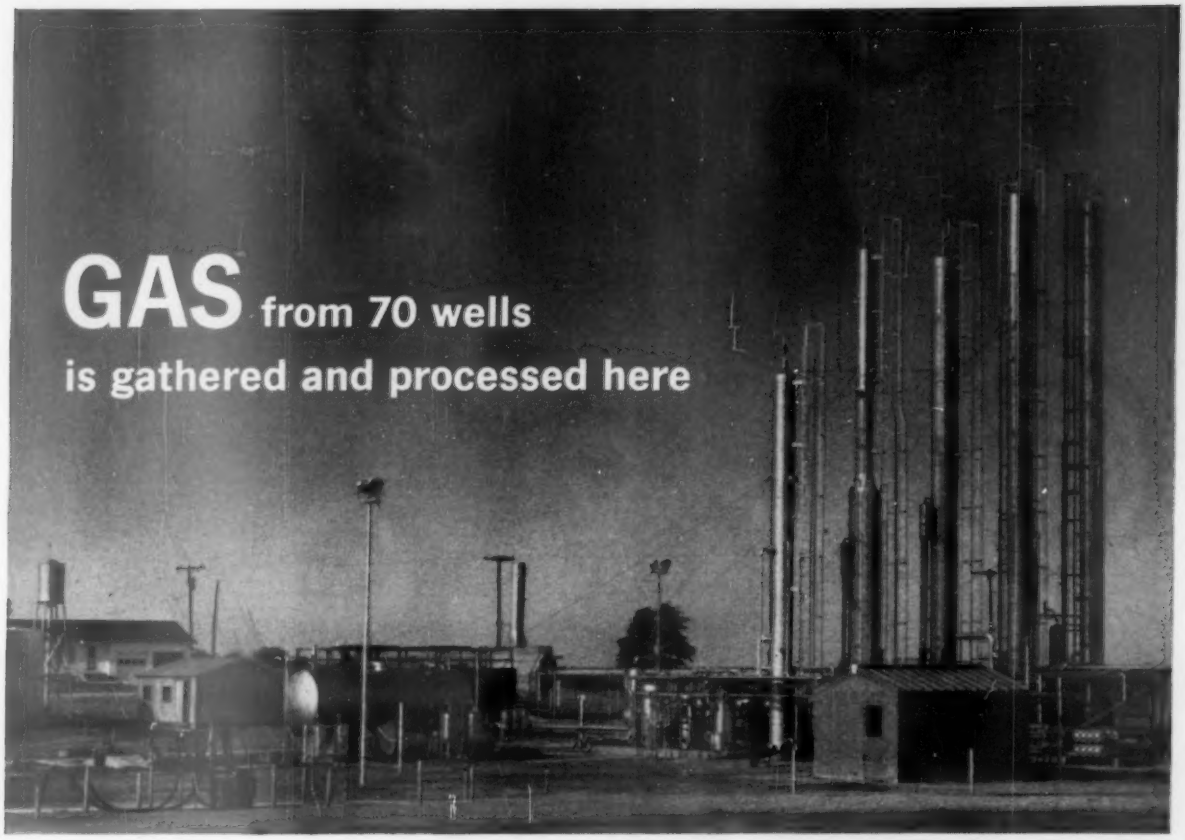
THE C. M. KEMP MANUFACTURING COMPANY
405 E. Oliver St., Baltimore 2, Md.



"JENKINS valves give us the dependable performance our operations demand."

— states Kerr-McGee Oil Industries, Inc., Oklahoma gas producer

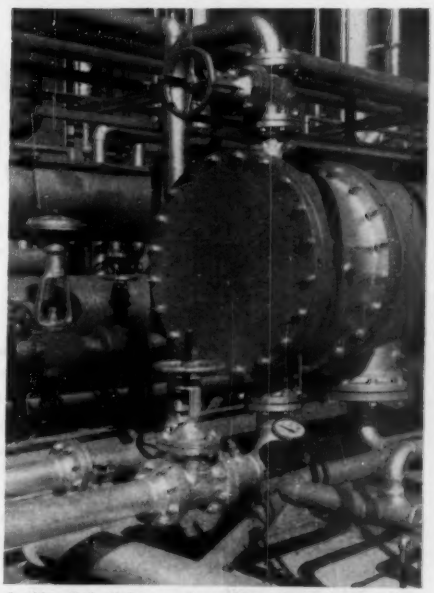
How Kerr-McGee's field processing plant in Lincoln County, Oklahoma, gathers and extracts valuable hydrocarbons from gas before delivering it to the consumer is an interesting story, briefly told below. But you need not know the process to appreciate the fact that maximum reliability in valves is a "must".

The valves that assure Kerr-McGee of dependable, trouble-free performance bear the same name as that written on piping lay-outs of critical jobs of all kinds for almost a century. Experienced engineers, contractors and operating executives know that "JENKINS" stands for an extra-measure of quality. They know it is the best guarantee of long, trouble-free service. There's no extra cost attached to this specification for extra quality, so you can use it for any job. Jenkins Bros., 100 Park Ave., New York 17.

HOW THE GAS PROCESSING PLANT WORKS...

Because it is a vapor at low pressure, gas is first compressed and injected into the bottom of a tall tower, called an absorber; oil is injected at the top. As the oil goes down, the gas goes up . . . the gas products are absorbed by the oil. The gas enriched oil is then processed to remove valuable light hydrocarbons.

Sold Through Leading Distributors Everywhere



Jenkins Gate Valves on lean oil cooler to the absorber

JENKINS
LOOK FOR THE JENKINS DIAMOND
VALVES
JENKINS SINCE 1864 Jenkins Bros

Electro-Motive power sets drilling record . . .

Kermac 46 hits 10,000 feet in 4 days, 22 hours

Kermac 47 strikes same depth in 5 days, 18 hours

Using three Electro-Motive 900-hp generating units to power electric drive motors on draw works, rotary and mud pumps, Kermac 46, drilling for Gulf Oil Corp., cut the established 10-day drilling record in half. This was accomplished by using heavy bit weight and high rotary speed.

Rotating at 150 to 275 rpm, rotary speed was slowed by adding weight to the bit rather than reducing rotary power. In spite of heavy loading, only five bits were used.

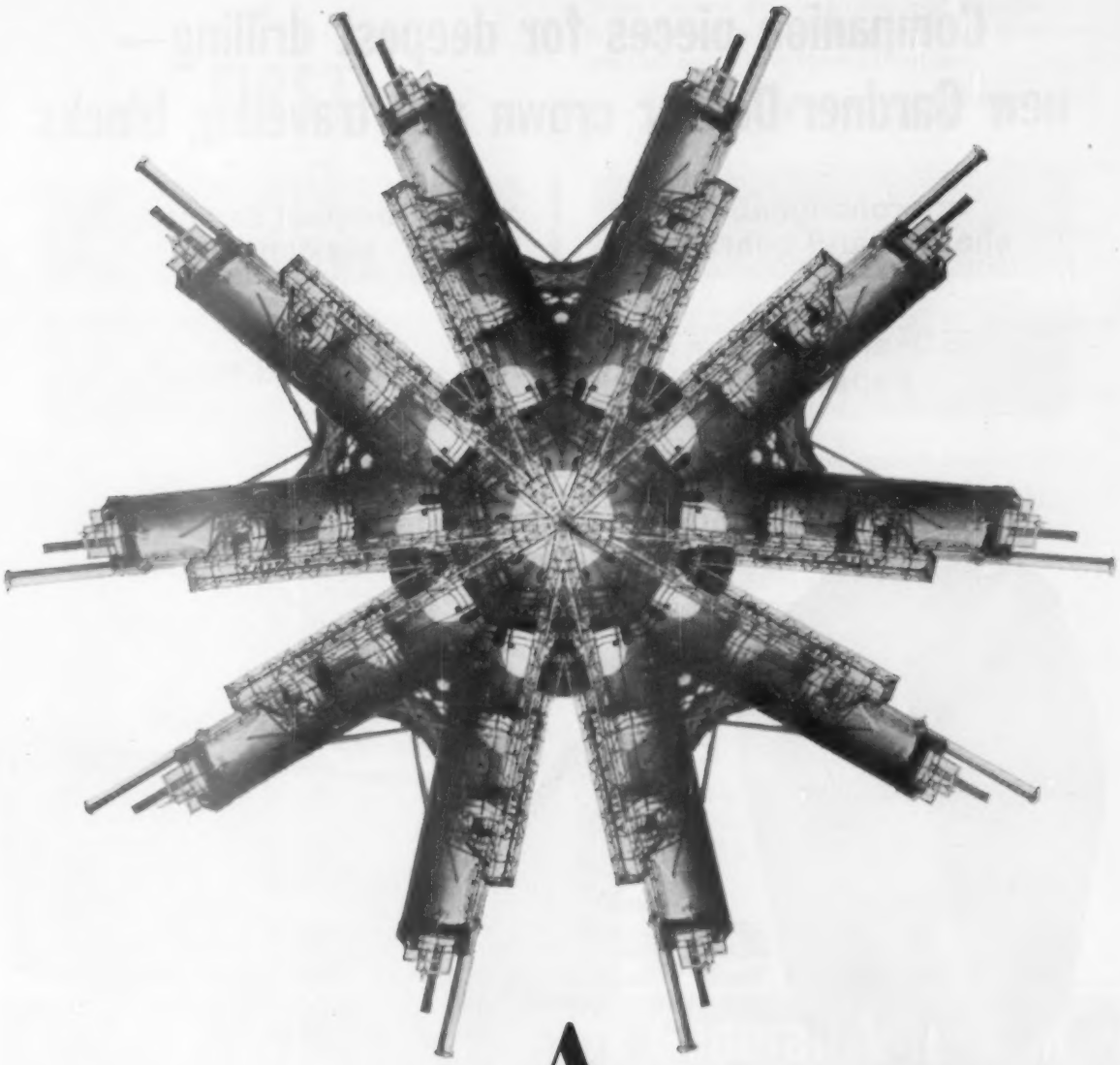
Direct current motors on Electro-Motive equipment are series wound, a factor that makes possible smooth and rapid acceleration of loads with positive control of speed and torque. Thus, accurate control of horsepower can be maintained over a full range of rotating speeds. Simple, single-cabinet controls provide the driller maximum flexibility in power distribution to shorten drilling time, lower costs.

This same drilling method of high rotary speed and heavy bit weight was utilized on Kermac 47 when it reached 10,000 feet in 5 days, 18 hours.

Electro-Motive Power is power to make hole fast; flexible to meet varying drilling conditions; simple, accurate controls; matched components, designed and built by *one* manufacturer—reasons why both land and offshore rigs are successfully reducing drilling time and costs. Why not ask your Electro-Motive representative for full details?

ELECTRO-MOTIVE DIVISION
GENERAL MOTORS · LA GRANGE, ILLINOIS

In Canada: General Motors Diesel Limited, London, Ontario
Petroleum Industry Sales Offices: Tulsa, Oklahoma; Houston, Texas; Dallas, Texas; Morgan City, Louisiana; Pasadena, Calif.



Always the perfect fit

Regardless of your requirements, there is a Davison cracking catalyst to fit your refining picture: 25% Alumina for highest activity maintenance — 13% Alumina for low cost octanes — Semi-Synthetic S-S for economical control of selectivity — Silica-Magnesia for maximum middle distillates. Nearly three-fourths of the refiners in the Western Hemisphere rely on Davison for superior catalysts and superior services. Contact our local field representative, or write Dept. A-05 today.

This unique kaleidoscopic photo technique is the experimental work of Cal and Don Young, Philadelphia, from a black and white photo by the Adams Studio, Odessa, Texas

DEPARTMENT A-05
W.R. GRACE & CO.
DAVISON CHEMICAL DIVISION
BALTIMORE 3, MARYLAND

Companion pieces for deepest drilling— new Gardner-Denver crown and traveling blocks

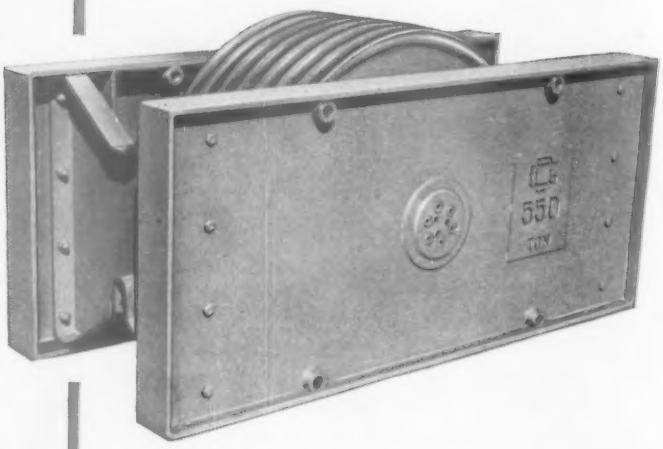
Interchangeable sheaves and bearings

Compact design... big capacity

550- and 400-ton capacities

Balanced travel

Sheave bearings individually lubricated from either end of shaft



New Gardner-Denver traveling blocks are engineered to provide straight, fast fall and easy movement during operation.

TRAVELING BLOCK SPECIFICATIONS

Capacity	Sheave Dia.	Weight
550 tons	60"	18,000 lb.
400 tons	50"	14,000 lb.

New Gardner-Denver reversible crown blocks are balanced for one-man rig-up. Symmetrical design for optional use of either outside sheave for fast line.

CROWN BLOCK SPECIFICATIONS

Capacity	Sheave Dia.	Weight
550 tons	60"	11,900 lb.
400 tons	50"	9,000 lb.

EQUIPMENT TODAY FOR THE CHALLENGE OF TOMORROW

GARDNER - DENVER

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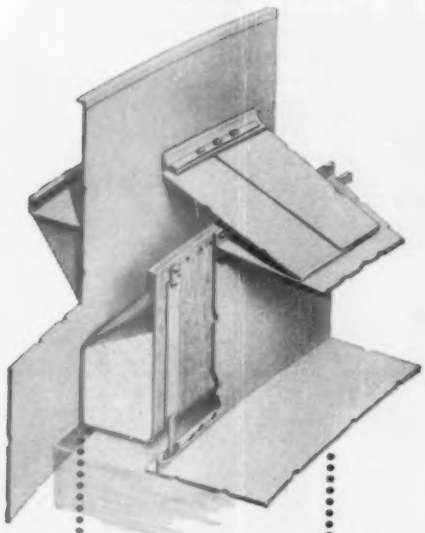
FIRST solid cushion seal



When General American developed EverSeal, first solid cushion seal for floating roofs, we wanted a seal that would have these advantages:

1. Simplicity of design, no moving parts, nothing to corrode
2. Permanent, indestructible sealing qualities—no gas or liquid to leak
3. Complete protection of coated tank walls from scuffing or gouging
4. A tough, pliable envelope that would withstand abrasion; ride without damage over projections on the shell
5. Ease of repair or replacement, without taking tank out of service
6. Maximum protection against evaporation loss
7. Full protection of oxygen-sensitive stocks
8. No build-up of vapors in the seal area

EverSeal is the *first* solid cushion seal to meet *all* these requirements. It is made of trapezoidal urethane foam cushions enclosed in a tough, scuff-proof envelope of Buna "N" synthetic rubber and polyvinyl chloride plastic.

EverSeal is almost impossible to damage, always provides a safe and complete seal for every floating roof.

Write or phone your nearest General American office for complete information.

It pays to plan with General American.

EverSeal*

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by General American

Plate & Welding Division

GENERAL AMERICAN TRANSPORTATION CORPORATION

135 South LaSalle Street • Chicago Illinois

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PLATE & WELDING DIVISION GENERAL AMERICAN

Performance makes the world of difference

Fig. 2201—Flanged End, semi-steel Lubricated Plug Valve for 175 W.O.G. Single gland type. Wrench operated.

Fig. 3058—Screwed End, carbon steel Lubricated Plug Valve, ASA 300 pound. Screwed gland type, wrench operated.

Fig. 2207G—Flanged End, semi-steel Lubricated Plug Valve for 200 W.O.G. Bolted Gland type. Worm gear operated.

Powell . . . world's largest family of valves

Powell Lubricated Plug Valves—a triumph of valve design and engineering—are preferred to control the flow of fluids in petroleum refineries, petro-chemical plants and oil storage facilities all over the world.

Note these Powell features: simple design (only three basic parts—body, bonnet, plug); fast opening and closing; straight streamline flow through when fully open; tapered plug for positive seating; carefully machined surfaces of plug and body are unexposed to and protected against the action of the fluid being handled when valve is open.

These valves are available in sizes from ½" through 16"; semi-steel, carbon steel, and, on special order, in other alloys. Consult your nearest Powell valve distributor, or write to us for the facts and illustrated literature.

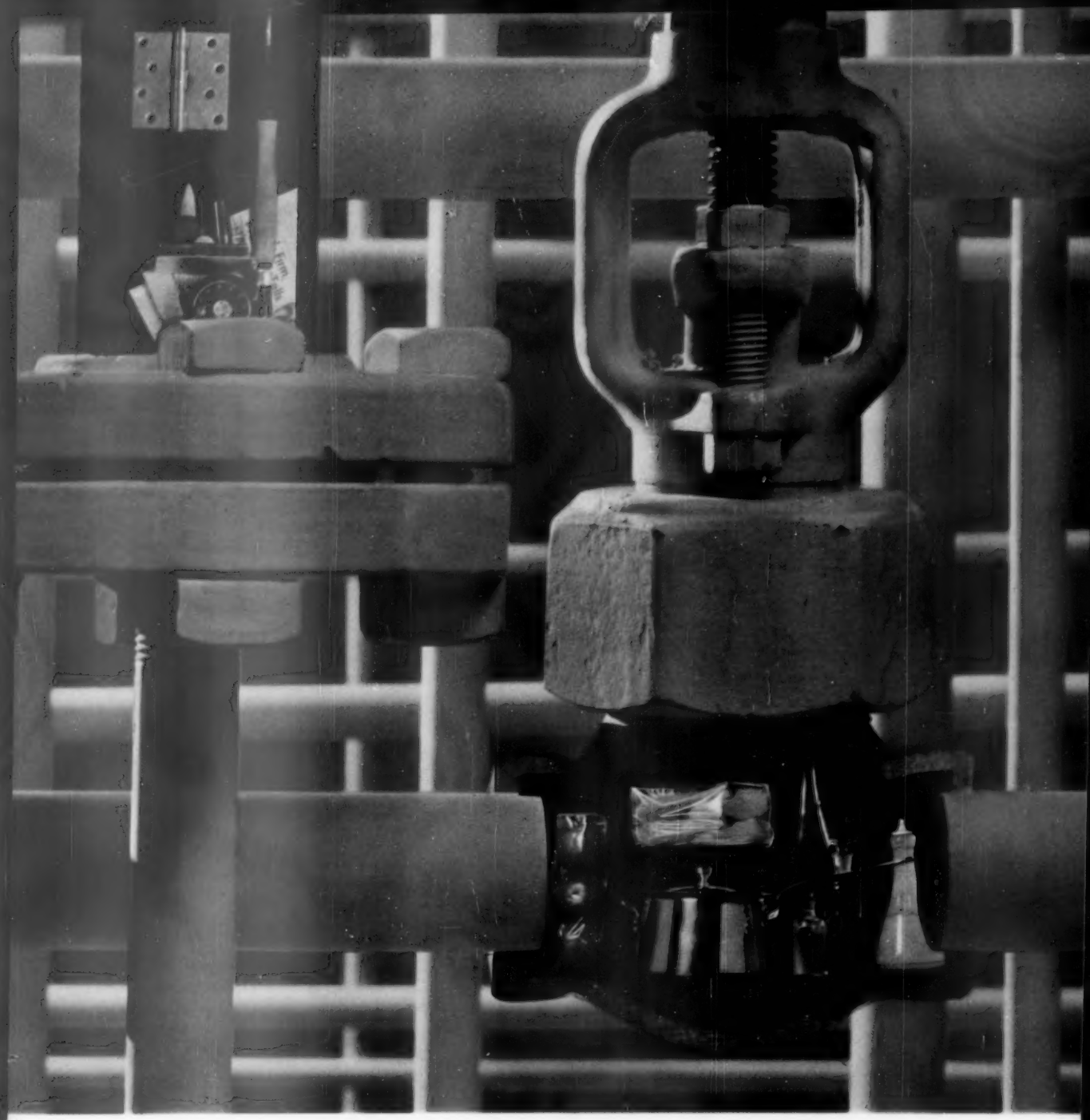
THE WM. POWELL COMPANY • DEPENDABLE VALVES SINCE 1846 • CINCINNATI 22, OHIO

"THE percentage depletion provision in our tax laws is deeply rooted in the economics of the oil business... It has been an incentive which has helped provide this country for decades with an abundant supply of oil."—*from the 1959 Annual Report*

STANDARD OIL COMPANY (NEW JERSEY)

Esso

FOR HELPFUL IDEAS ON THE CHEMICALS
THAT GO INTO YOUR PRODUCTS,
YOU'LL LIKE DOING BUSINESS WITH
COLUMBIA-SOUTHERN



You can count on smooth production when you use Columbia-Southern chemicals, because they'll be delivered to you on time, in the grades and quantities ordered. You'll find the quality consistently high, too.

But you get far more than prompt delivery and consistent quality when you work with Columbia-Southern. You can call on Columbia-Southern's solid experience in chlorine, alkalies, and related chemicals to help you improve the efficiency of your processing activities. Your Columbia-Southern Representative will give you sound, profit-building advice on such vital matters as forms and grades, transportation economics, storage methods, safety precautions, and applications.

Why not start with a general survey of your current purchases? Call in your local Columbia-Southern Representative and let him work with you in evaluating every step. You'll be glad you did.

Columbia-Southern Chemical Corporation, One Gateway Center, Pittsburgh 22, Pa. Offices in fourteen principal cities. In Canada: Standard Chemical Limited.

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COLUMBIA-SOUTHERN CHEMICAL CORPORATION
A Subsidiary of Pittsburgh Plate Glass Company

Chlorine • Caustic Soda • Caustic Potash • Soda Ash • Ammonia
Solvents • Sodium Bicarbonate • Chromium Chemicals
Barium Chemicals • Sulfur Chemicals • Agricultural Chemicals
Reinforcing Pigments • Calcium Chloride • Hydrogen Peroxide
Muriatic Acid • Calcium Hypochlorite • Titanium Tetrachloride

seal

CONSOLIDATED SAFETY RELIEF VALVE'S Sealing Bellows protects against damage from contaminants, corrosion, or viscous fluids

saves

Consolidated Safety Relief Valves are available in both Balanced Bellows and Standard designs. The Standard type has an eductor tube that effectively removes bonnet pressure.

Balanced Bellows Type Consolidated Safety Relief Valves have a durable, two-ply stainless steel Sealing Bellows that isolates and protects working parts from destructive elements in the lading fluid.

The bellows is balanced with the seating surface. Even with superimposed back pressure in the relieving system, valve performance is consistently stable and dependable. The bellows does not affect the high capacity of the valve, nor does it require change in set pressure. Even the blowdown adjustments are limited.

Additionally, Consolidated Safety Relief Valves now offer a no-leak tightness maintained by a resilient "O" Ring Seat Seal retained in the valve disc. This Seal assures tightness at operating pressures far closer to set pressure than with metal-to-metal seats alone, yet does not carry the seat load imposed by the spring. The Seal also takes piping strains much better than all-metal seating.

The Sealing Bellows and "O" Ring Seat Seal are typical of the extra quality built into Consolidated Safety Relief Valves to assure absolute protection for personnel and plant. These fine features plus flat seating and single ring construction also eliminate many maintenance problems and costs. Write for Catalog 1900 and Bulletin 1940.

MAXWELL MANNING M&M & MOORE INC. TRADE MARK

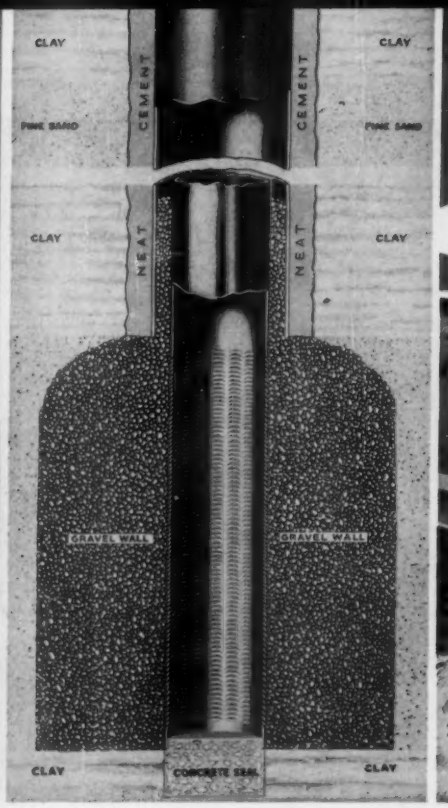
CONSOLIDATED SAFETY RELIEF VALVES

A product of

MANNING, MAXWELL & MOORE, INC.

Valve Division • Tulsa, Oklahoma

In Canada: Manning, Maxwell & Moore of Canada, Ltd., Galt, Ontario



WATER WATER WATER

With A Layne Drilled Well Layne knows where the water-bearing formations are located. They have been drilling wells for over 75 years. This experience comes from searching and researching water aquifers. Knowing *where* to drill is half of the success—knowing *how* is the other half. In drilling a straight well experience counts—and you can count on Layne. Layne specializes in water well drilling. To get a good start for a water supply—you need a good well. You get a good, producing well when you specify a Layne drilled well. *Bulletin No. 100*

With A Layne Gravel Wall Well This technique and resulting arrangement of the new 134 Shutter Screen and gravel (shown here) permits the free flow of water into the well and affords the following advantages: larger shutter screen openings, reduced friction, reduced draw down and pumping head—thereby reducing pumping costs, increased specific capacity and more effective retention of native sands. Cemented wells are installed if indicated, and result in greater purity of supply as well as increased life of the well. *Bulletin No. 900*

With A Layne Vertical Turbine Pump Whatever the pumping requirement, there's a Layne pump to meet any pumping conditions. Layne Vertical Turbine Pumps come in a wide range of sizes and capacities, delivering 30 to 20,000 GPM and requiring from 4 to 42 inch well casings. The complete line of Layne Pumps include: Deep Well Vertical Turbine (oil or water lubricated), Short Coupled Vertical Turbine, Propeller, Mixed Flow, Fire Pumps and Volatile Liquids Pumps, Regular and "In-Line" Submersible. *Bulletins No. 200 (oil) 201 (water)*

LAYNE OFFERS COMPLETE WATER SERVICE: Initial surveys • explorations • recommendations • site selection foundation and soil-sampling • well drilling • well casing and screen • pump design, manufacture and installation construction of water systems • maintenance and service • chemical treatment of water wells • water treatment—all backed by Layne Research. Layne services do not replace, but coordinate with the services of consulting, plant and city engineers.

Layne SINCE 1902 — WORLD'S LARGEST WATER DEVELOPERS

LAYNE & BOWLER, INC., MEMPHIS

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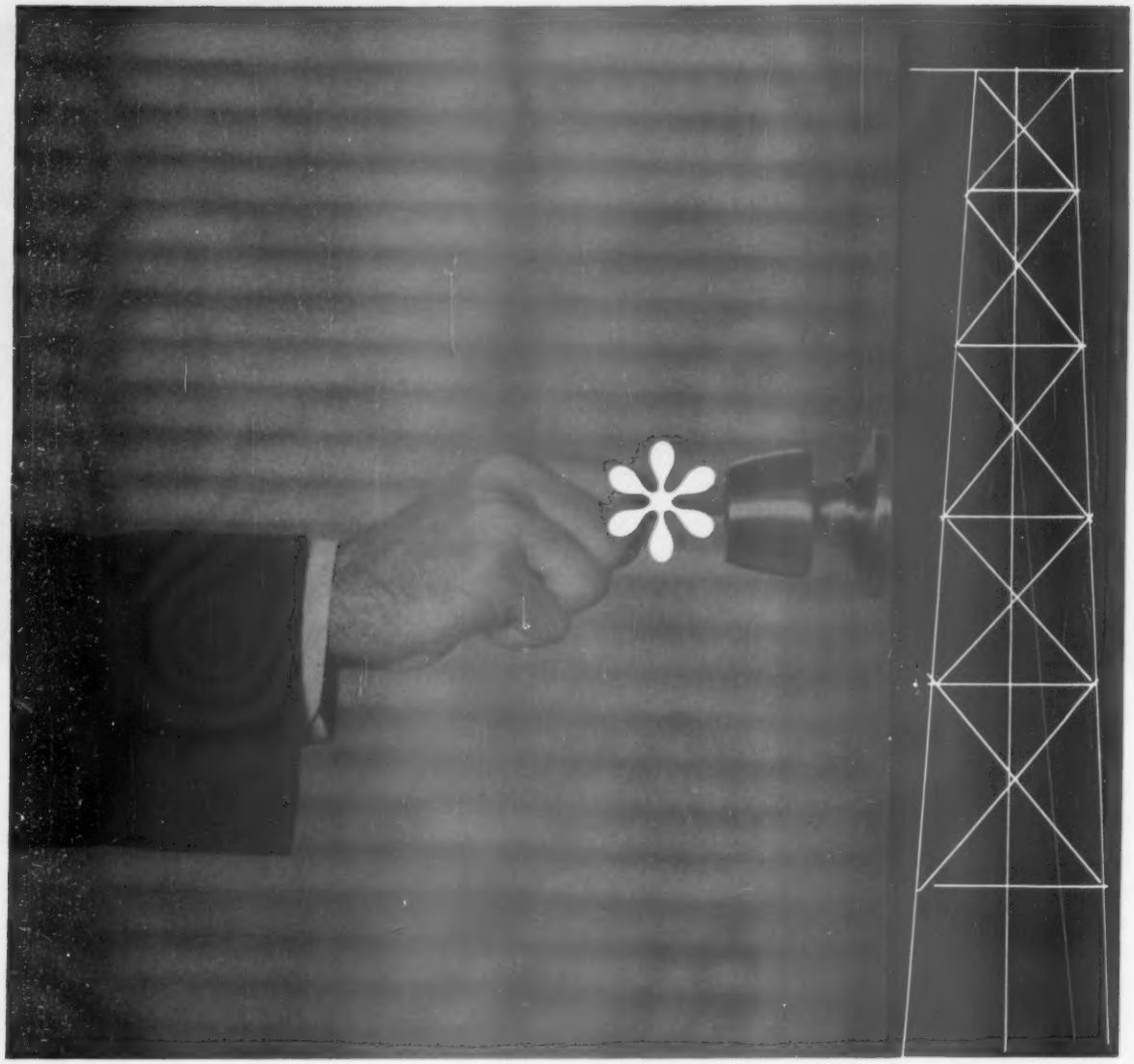
Sales Representatives in Major Cities



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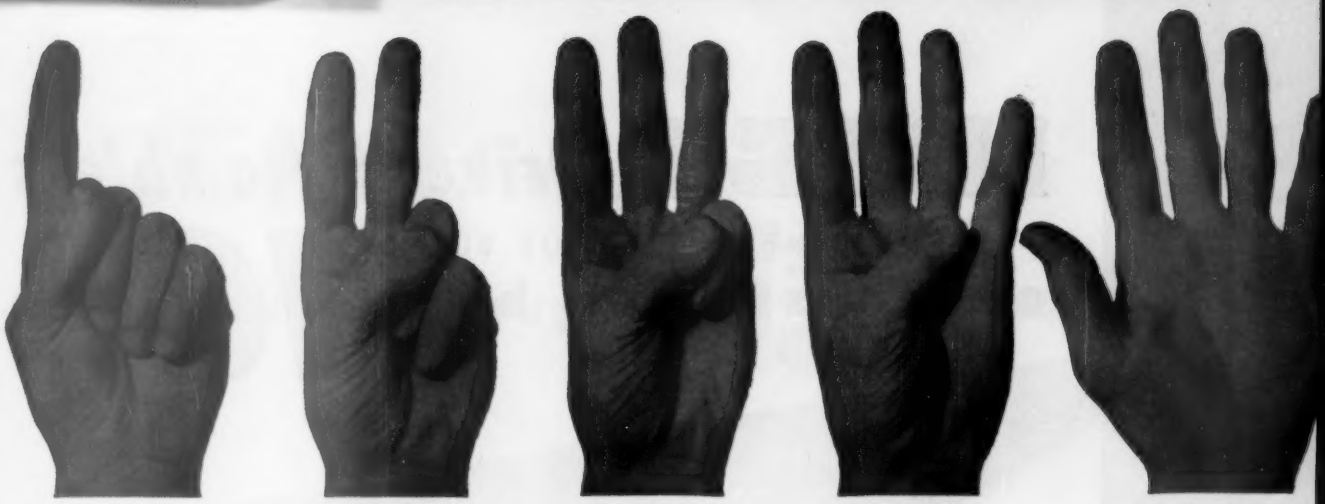

BETTER drilling rates in all types of muds: T-8, lime, gyp, and low pH, with varying amounts of oil.

BETTER (lower) barite requirements when substituted for oil in muds.

BETTER hole lubrication, in all types of muds, to reduce pipe sticking.

BETTER bit bearing life **even in high solids muds.**

BETTER geological interpretation and electrical logs; no fluorescence.

PLAN WITH BIT LUBE to drill 5 ways better . . .

MAGCOBAR PLANNED MUD PROGRAMS make the above statements facts, not claims. In high weight emulsion muds, for example, the Magcobar engineer properly substitutes Bit Lube® for some of the oil to cut drilling costs by reducing the amount of barite required. In a typical well, the oil content of the mud was allowed to drop from 11 to 5 per cent. Bit Lube was added to this 17.8 lb./gal. lime mud with these savings in barite:

	Sacks of barite per day	Cost of barite per day	Cost of Bit Lube per day	Cost of Oil per day	Total Cost per day
Emulsion (2 week average)	177	$409.76	$—0—	$74.03	$483.79
Bit Lube and Emulsion (3 week average)	52	120.38	122.43	8.25	251.06

NET DAILY SAVINGS WITH BIT LUBE: $232.73

Not only does Bit Lube give direct cost savings, but it also offers escape from costly pipe sticking, even in extreme directional holes. Bit Lube lowers the friction coefficient of the mud, to give over-all higher drilling mud performance. These savings can be added to those in the chart.

The skilled use of good products like Bit Lube to cut drilling costs is the heart of Magcobar Technology. Let the Magcobar engineer plan the mud program for your next well and this Technology will save for you all along the line.

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Complete
DRILLING MUD SERVICE

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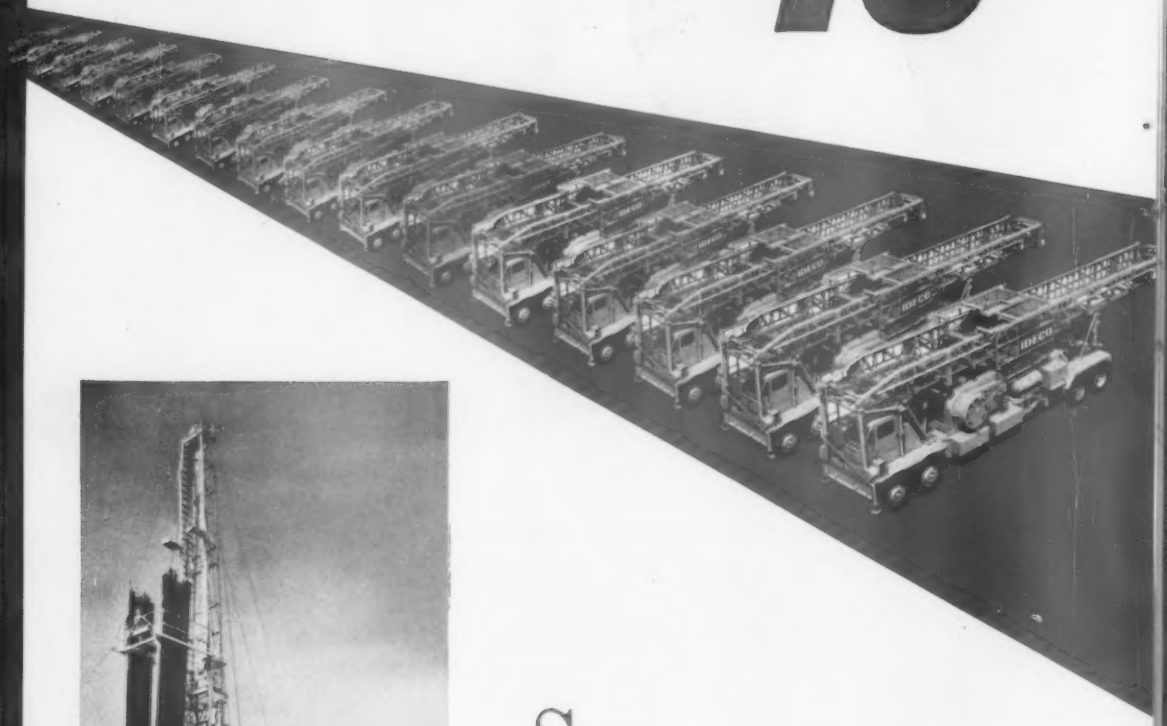
MAGNET COVE BARIUM CORP.
HOUSTON

IDECO *Drive-in Ramblers*

RECENT SALES—MUY BUENO

one customer buys 16



One of the many Ideco Drive-In Ramblers built for operation in the United States and abroad.

Sixteen Drive-In Rambler rigs to one customer . . . proof of the ever-increasing acceptance of Ideco drilling, servicing and workover equipment as the recognized standard of the industry. Ideco Drive-In Ramblers were chosen because of their rugged construction, ease and economy of operation and because they're *faster to the job* and *faster on the job*. One engine, one torque converter and one transmission all do double duty for both roading and rig operation. The forward-mounted Ideco Kwik-Lift mast travels rigged-up. Hydraulically-raised and telescoped, the mast can be ready for work in minutes. Ask a man who owns a Drive-In, then ask your Ideco man for full details. "Drive-In" to your next location with an Ideco Drive-In Rambler.

IDECO

P. O. BOX 1331 • DALLAS 21, TEXAS

IDECO Mud-Master Pumps

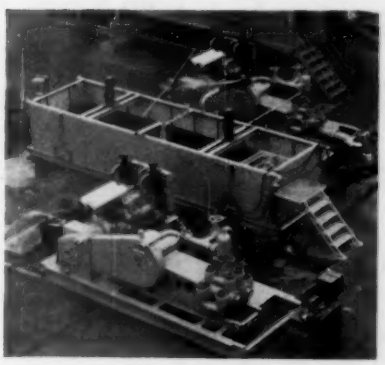
RECENT SALES—MUY BUENO

six customers buy 53 more

One of 12 trailer-mounted MM-200 pumps for one customer.

Fifty-three mud pumps to six customers in six months . . . proof positive of the superiority of Ideco equipment. You, too, can look to Ideco for leadership in modern high-pressure, heavy-duty mud pumps proved and approved around the world. And there's the *right* pump for your every drilling requirement in Ideco's line of 12 all-steel models. Duplex pumps are available in 200, 300, 450, 600, 700, 1000 and 1250 horsepower sizes; triplex pumps are available in 440, 600, 880, 1000 and 1250 horsepower sizes.

If you are operating abroad remember that Ideco rigs and pumps are available from licensed European manufacturers — inspected, tested, sold, serviced and fully guaranteed by Ideco and affiliates.



Two MM-300 pumps being assembled for testing prior to shipment to Argentina.

P. O. BOX 1331 • DALLAS 21, TEXAS

IDECO

They Say—

Amount is what counts

Dear Sir:

With reference to The Oil and Gas Journal, April 25 issue, Clyde La Motte's comments on p. 103 ("Watching Washington"), it seems to me that the matter of natural-gas off-peak sales is analogous to incremental refining throughput.

As long as there is only a small amount done, those doing it gain. When it becomes widespread, it becomes a market depressant.

D. Eugene Norris
Assistant Director,
Crude Oil Purchase and
Sales Division
Sun Oil Co., Philadelphia

Interior's Bennett

Dear Sir:

The story (OGJ, April 25, p. 116, "Interior's Bennett Handles the Tough Jobs") is most generous.

I feel it is only fair to say that Secretary Seaton has done and is doing a superb job in the leadership he is rendering to the Department of the Interior in the interests of wise management of our resources.

His is the endless task of sifting the wheat from the chaff and coming up with the right answers, which, in turn, establishes the record for the department on which we all must stand or fall. He has never been reluctant to make and issue the "unpleasant" decisions. When I issue "unpleasant" announcements they are within broad policy concepts already laid down by the Secretary.

Elmer F. Bennett, Under Secretary
Department of the Interior
Washington, D. C.

Too optimistic?

Dear Sir:

I have read "How Drilling Looks After 3 Months" (OGJ, April 4, p. 61) with much interest, just as I did your original forecast for 1960. I thought you were optimistic then, and I still feel that your new look is colored by the rosy tint of your glasses.

During all last year I preached to the drilling contractor that he could not reasonably expect any substantial increase in the rate of drilling for 1959, 1960, or even 1961. There is nothing in the economic picture of the petroleum business in the United States which justifies any other opin-

The OIL AND GAS JOURNAL

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*SMOOTHLY . . .

From watches to locomotives, mechanical parts work better together when they're designed and built to work together. The same is true for mud pump parts. With the Mission Guarantee you know that individually each part—liners, pistons, rods, valves and seats, packing, and springs—will outperform any others. But, when you put them together, allow them to do their best, the savings you get are even greater. And the other side of savings is your profit.

When you put Mission pump parts to work you know you're using the best, that's guaranteed; but you also are helping yourself the most, cutting your own costs. Start now to stop the waste of shopping around and standardize on Mission all the way.

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60—800

ion, if one desires to be realistic and conservative.

Many of the forecasts were based on the estimates of increased consumption year by year, without taking into consideration the continuing pressure of imports against our domestic requirements, nor the lack of substantial discoveries in this country, nor the increasing tendency to wider well spacing coupled with the reluctance on the part of major companies to develop their discoveries at too rapid a rate.

My guess is that we will drill no more wells this year than we did in 1959, and if I were a gambler I would bet that we will not drill as many. Nevertheless, being in the drilling business, I hope that your forecast will be justified by the statistics, come the year end.

J. Zeppa
President
Delta Drilling Co.
Tyler, Tex.

(Editor's note: In preparing the drilling report, the Journal talked to many companies about their drilling plans. The article reflects the composite opinion of those we contacted. We're keeping our fingers crossed too.)

They're available

Dear Sir:

I have found your Cost-imating booklet to be very useful, and I feel that Dr. Nelson should be complimented on the scope and presentation of his facts.

I should be glad to know if you have now published a more recent edition of this, and if so, what is the price.

Philip B. Hindell
Beirut, Lebanon

(Editor's note: Reprints of "Complete Cost-imating" (construction costs, price $2.50) 1948-1957 and the later series, "Process Cost-imating" (first half of a planned series on process costs, price $1.50) are available. Write Reader Service, Box 1260, Tulsa).

Colorful presentation

Dear Sir:

The presentation of my paper in the April 25 issue of The Oil and Gas Journal ("It's up to Geologists to Make Palynology a Working Tool," p. 136) was very well done. I would like to compliment you on the fine job that you did on it—including the "colorful" presentation.

John F. Grayson
Senior Research Palynologist
Socony Mobil Oil Co.
Dallas

Letters to They Say should be addressed to The Editor, The Oil and Gas Journal, Box 1260, Tulsa, Okla.

CALENDAR OF EVENTS

MAY

16-17 International Society of Professional Well Log Analysts, first annual meeting, Tulsa Hotel, Tulsa.

18-20 American Petroleum Institute, Division of Marketing, midyear meeting, Statler-Hilton Hotel, Cleveland.

22 Pennsylvania State University, short course in reservoir engineering, University Park, Pa. Term ends June 10.

22-25 National Association of Purchasing Agents, annual convention, Biltmore Hotel, Los Angeles.

22-26 Air Pollution Control Association, annual meeting, Netherland-Hilton Hotel, Cincinnati.

23-24 American Gas Association, production meeting, Roosevelt Hotel, New York City.

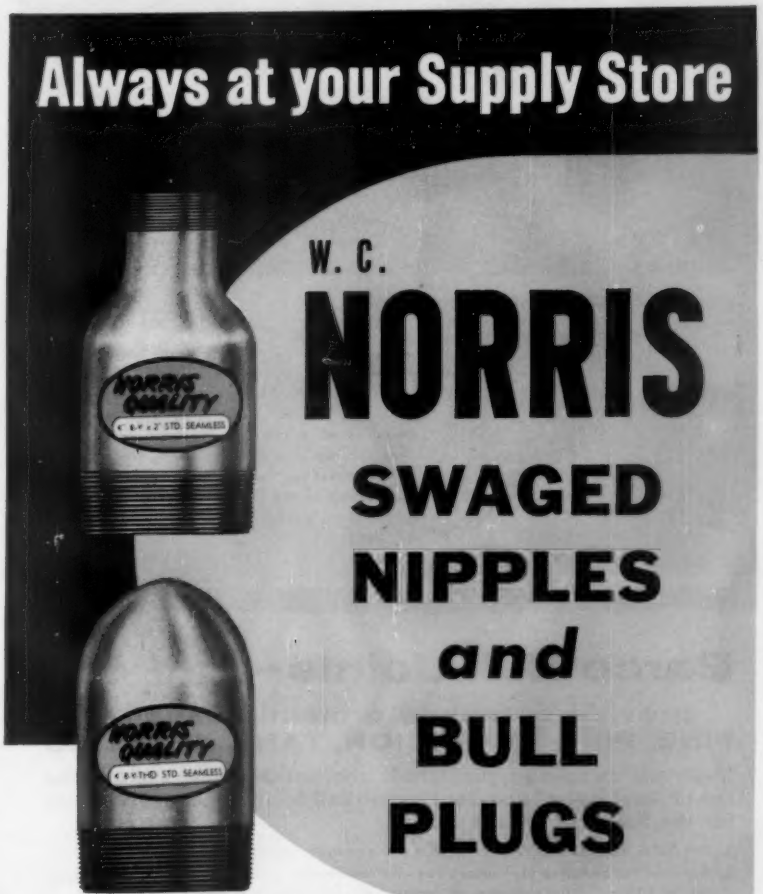
23-26 American Society of Mechanical Engineers, oil and gas power conference and exhibit, Muehlebach Hotel, Kansas City.

24-25 Western Petroleum Refiners Association, computer conference, Ben Milam Hotel, Houston.

24-26 American Right of Way Association, annual seminar, Shoreham Hotel, Washington.

25-27 Pacific Coast Gas Association, accident prevention and transmission conference, Hotel Utah, Salt Lake City.

25-28 American Association of Petroleum Geologists, western Canada regional



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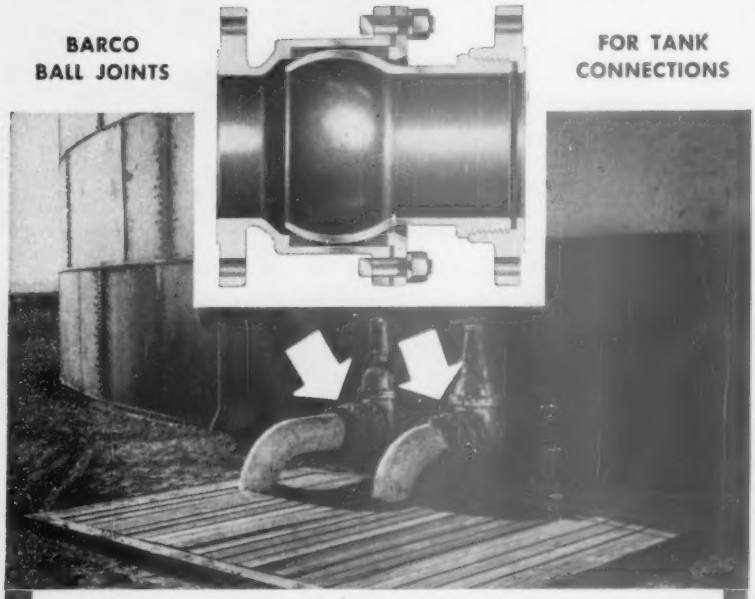

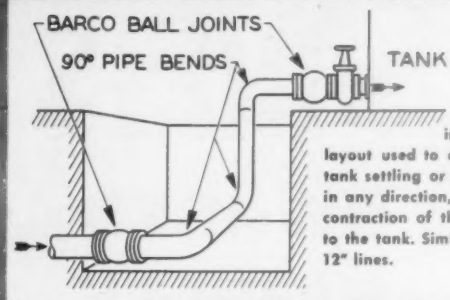

FLEXIBLE!

This schematic diagram indicates the type of piping layout used to allow for up to 6 inches of tank settling or 6 inches of tank movement in any direction, and also for expansion or contraction of the long run of pipe leading to the tank. Similar piping is used for both 12" lines.

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meeting, Banff Springs Hotel, Banff, Alta.

26-27 Natural Gas and Petroleum Association of Canada, meeting, Niagara Falls, Ont.

JUNE

1-3 Texas College of Arts and Industries, fifteenth annual short course on gas technology, sponsored by Southern Gas Association, Kingsville, Tex.

1-3 West Virginia University, fifth annual Appalachian underground corrosion short course, Morgantown, W. Va.

2 Pennsylvania Grade Crude Oil Association, annual meeting, Pennhills Club, Bradford, Pa.

2-3 Kentucky Oil and Gas Association, annual meeting, Phoenix Hotel, Lexington.

5-9 American Society of Mechanical Engineers, summer annual meeting, Dallas.

5-10 Society of Automotive Engineers, summer meeting, Edgewater Beach Hotel, Chicago.

9-11 Manufacturing Chemists' Association, annual meeting, The Greenbrier, White Sulphur Springs, W. Va.

13-15 American Association of Cost Engineers, annual meeting, Rice Hotel, Houston.

13-15 Chemical Institute of Canada, annual conference and exhibition, Chateau Laurier, Ottawa.

13-15 Interstate Oil Compact Commission, midyear meeting, Statler Hilton Hotel, Detroit.

15-16 Western Petroleum Refiners Association, Mid-Continent regional technical-industrial relations meeting, Hotel Lassen, Wichita.

19-22 American Institute of Chemical Engineers, Instituto Mexicano de Ingenieros Quimicos, joint meeting, Hotel Del Prado, Mexico City.

22-25 Canadian Gas Association, annual meeting, Manoir Richelieu, Murray Bay, Quebec.

22-25 American Association of Petroleum Landmen, national convention, Ambassador Hotel, Los Angeles.

25-29 Petroleum Equipment Suppliers Association, annual meeting, Banff Springs Hotel, Banff, Alta.

25-July 5 First International Congress for Automatic Control, Moscow, U.S.S.R.

26-28 North American Gasoline Tax Conference, annual meeting, southern region, Eden Roc Hotel, Miami Beach.

26-July 1 American Society for Testing Materials, annual meeting and exhibit, Chalfonte-Haddon Hall, Atlantic City, N. J.

27-28 Michigan Gas Association, Mackinac Island, Mich.

JULY

18-29 Massachusetts Institute of Technology, dynamics and control of chemical engineering processes program, Cambridge, Mass.

28-30 American Petroleum Institute, Division of Production, Eastern district meeting, The Greenbrier, White Sulphur Springs, W. Va.

AUGUST

3-5 Wyoming Geological Association, field trip to Snyder basin and Wind River Mountains, Casper.

14-19 National Congress of Petroleum Retailers, Inc., annual session, Shamrock-Hilton Hotel, Houston.

15-17 American Society of Mechanical Engineers, American Institute of Chemical Engineers, heat transfer confer-

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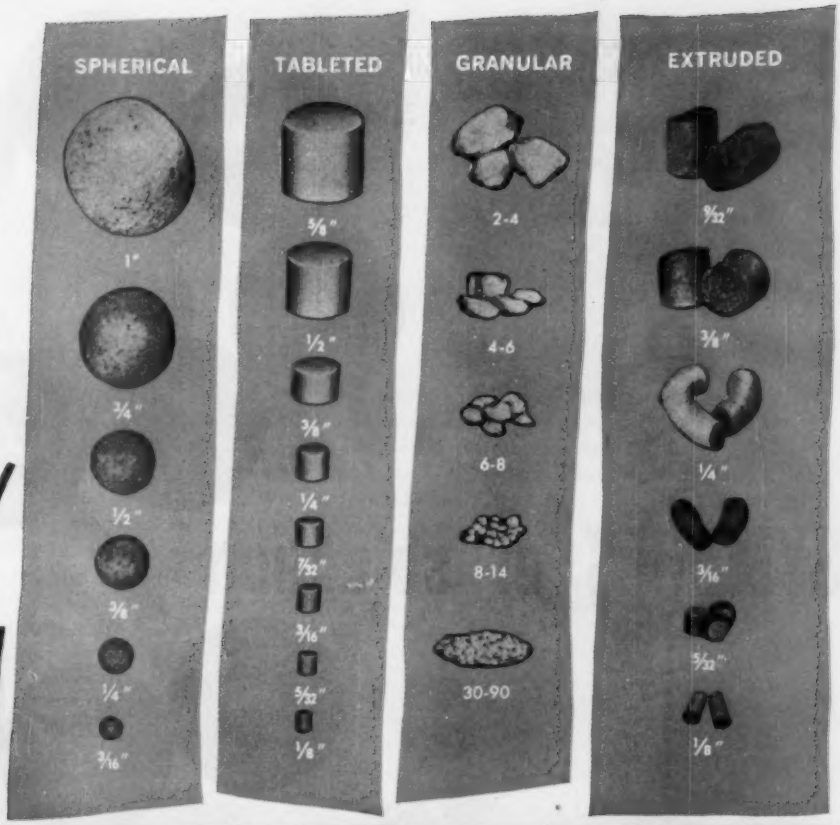

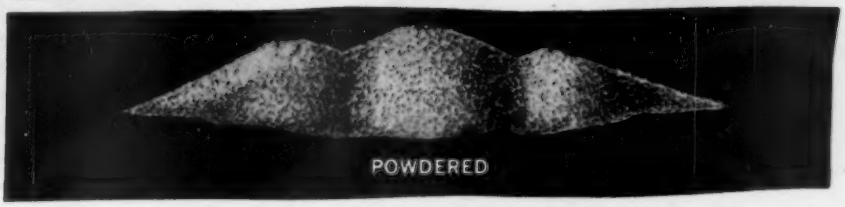

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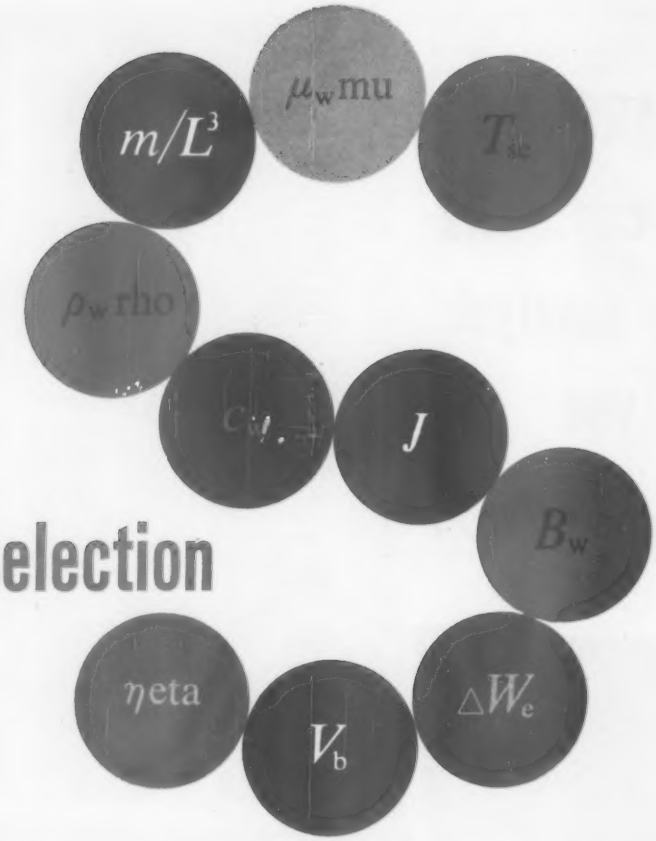

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NEW SUPER RETARDER, HR-12 has already been used successfully below 19,500 feet and at bottom hole temperatures exceeding 350° F. This new retarder seems to be the answer to cementing the deep wells of today . . . and the deeper wells of tomorrow. This latest advancement from Halliburton Research is proving itself to be a real money-saver. With improved efficiency in its ability to retard cement setting time, far less HR-12 is required in cementing at usual depths than with other retarders . . . and its amazing success in withstanding extreme well temperatures and pressures is extending the depths at which wells can be successfully cemented. HR-12 may be used with common or retarded cement, Pozmix Cement or Pozmix 140.

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REDUCE SLURRY DENSITY WITH DIACEL D! Diacel D is designed to increase slurry yield while reducing its density. It is a special grade of diatomaceous earth which can be used with common cement in concentrations up to 40% to produce a slurry density as low as 11.0 pounds per gallon.

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ence and exhibit, Statler Hilton Hotel, Buffalo, N. Y.

15-26 Sacramento State College, summer institute on nondestructive testing, Sacramento, Calif.

22-26 Gordon Research Conference, catalysis, Colby Junior College, New London, N. H.

29-31 Appalachian Gas Measurement Short Course, University of West Virginia, Morgantown, W. Va.

30-Sept. 2 American Association for the Advancement of Science, Alaska Division, eleventh Alaskan science conference, Anchorage.

SEPTEMBER

6-7 Chemical Institute of Canada, organic chemistry division conference, Edmonton.

7-9 American Society of Mechanical Engineers, joint automatic control conference, Massachusetts Institute of Technology, Cambridge, Mass.

8-9 National Research Council, Chemical Institute of Canada, tenth Canadian high polymer forum, Alpine Inn, Montreal.

8-9 Mid-Continent Oil and Gas Association, Louisiana-Arkansas division, annual meeting, Roosevelt Hotel, New Orleans.

8-10 Chemical Institute of Canada, western regional conference, Regina.

8-10 Intermountain Association of Petroleum Geologists and Eastern Nevada Geological Society, field trip, economic geology of east-central Nevada.

11-16 American Chemical Society, national meeting, New York City.

14-15 Western Petroleum Refiners Association, Rocky Mountain regional technical-industrial relations meeting, Henning Hotel, Casper, Wyo.

14-16 National Petroleum Association, annual meeting, Traymore Hotel, Atlantic City, N. J.

15 Natural Gasoline Association of America, Rocky Mountain regional meeting, Palliser Hotel, Calgary.

18-21 American Society of Mechanical Engineers, petroleum mechanical engineering conference, Jung Hotel, New Orleans.

19-21 Texas Mid-Continent Oil and Gas Association, annual meeting, Hilton Hotel, San Antonio, Tex.

21-23 Pacific Coast Gas Association, annual meeting, Westward Ho Hotel, Phoenix.

23 Oklahoma Utilities Association, gas division meeting, Biltmore Hotel, Oklahoma City.

25-27 American Association of Oilwell Drilling Contractors, annual meeting, Roosevelt Hotel, New Orleans.

25-28 American Institute of Chemical Engineers, meeting, Mayo Hotel, Tulsa.

25-28 American Institute of Electrical Engineers, petroleum industry committee, electrical conference of the petroleum industry, Hotel Skirvin, Oklahoma City.

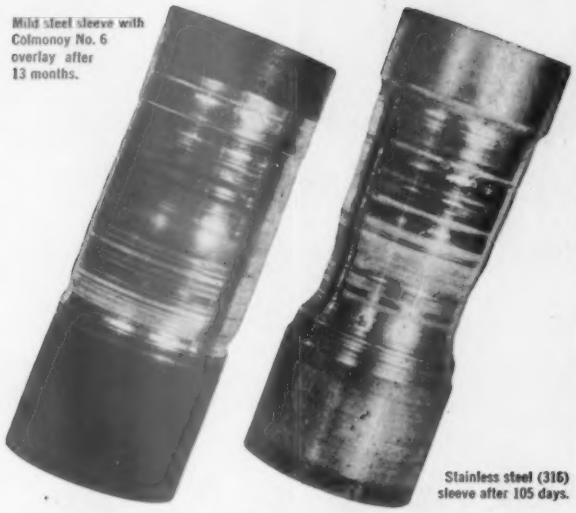
26-30 Instrument Society of America, instrument-automation conference and exhibit, and fifteenth annual meeting, Coliseum, New York.

29-30 Mid-Continent Oil and Gas Association, Mississippi-Alabama division meeting, Grand Hotel, Point Clear, Ala.

OCTOBER

2-5 Society of Petroleum Engineers of AIME, annual fall meeting, Denver.

3-4 Independent Natural Gas Association of America, annual meeting, Fontainebleau Hotel, Miami Beach.



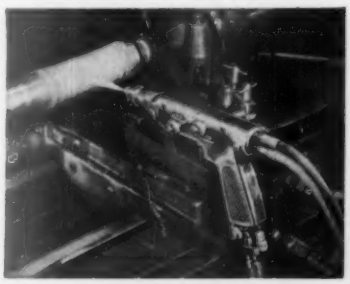
Mild steel sleeve with Colmonoy No. 6 overlay after 13 months.

Stainless steel (316) sleeve after 105 days.

Colmonoy Hard-Surfaced Mild Steel Pump Sleeve Lasts Longer Than Stainless Steel Sleeve

Here's dramatic evidence of how Colmonoy hard-surfacing alloys can lower maintenance costs. Both pump sleeves (above) served in a Desalta charge pump, moving crude oil. The one at the right, made of 316 stainless steel, was photographed after 105 days in service (involving eight packing changes). The other one, made of mild steel with a sprayed overlay of Colmonoy No. 6 alloy, served over three times as long (with just one repacking), yet suffered much less wear.

Colmonoy No. 6 is a wear-resistant nickel-base alloy incorporating chromium borides and carbides. The powdered alloy is sprayed on with the Colmonoy Spraywelder, as shown. The smooth sprayed overlay is then fused to the base metal with an oxy-acetylene flame to form a solid, non-porous, wear-resistant overlay.



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For the Colmonoy Spraywelder Catalog and Hard-Facing Manual No. 79

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- Fits any API seating device; use adapter for other types
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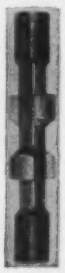

Fig. 201A

COMBINATION ROD GUIDE and PARAFFIN SCRAPER

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Some oil men think that completing a well means nothing more than putting holes in a pipe. Most anybody can do that.

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What about cost? If you want nothing more than holes in your pipe, you may find someone cheaper. But why risk a million dollar investment by choosing a company a few dollars cheaper in price but thousands of dollars short in experience and know-how.

What about new services? Through the years Welex has always led the field in offering new, proven Completion Services. As originator of jet perforating, Welex has more experience and technical know-how in this field than any other company. Welex's research engineers already are working on new developments that will become standards of the industry in the future, just as many of their past developments are now standards.

What about different types of wells? Here's another important question—and answer which again makes Welex the best choice. Welex is the *only* wireline service company offering a *complete* selection of Completion Services for *every* well condition, whether cased hole, through tubing, tubingless or open hole.

And speaking of hole conditions, Welex has the most complete selection of perforating guns for every type of hole. Let Welex's experienced engineers solve your completion problems.

Experience?

There's no substitute for experience.

In well completions, the company with the most experience is the logical choice.

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General Offices: 1400 East Berry, Fort Worth, Texas
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50 years ago

May 20, 1910

Petroleum Publishing Co. (The Oil and Gas Journal) moves publication headquarters of newly acquired Oil Investors Journal from Beaumont, Tex., to Tulsa. A. V. Bourque will maintain office in Houston as Gulf Coast news representative.

Rapid buildup of large flush production in new Caddo deep field in northwestern Louisiana threatens markets of eastern producers of high-grade oil. Direct competition feared because of comparable high quality of Caddo crude, unlike most other Mid-Continent and southwestern crude used primarily for fuel rather than lube stock. Trees Oil Co.'s No. 9 Stiles joins mounting list of Caddo gushers with flow of more than 10,300 bbl. daily from 2,310 ft.

25 years ago

May 16, 1935

First wind-driven generator units developed for cathodic protection of pipelines not accessible to power lines prove successful in initial installations on the Texas Pipe Line Co.'s Dayton-Port Arthur line on the Texas Gulf Coast.

New Texas law tightens reins on control of "hot-oil" production by providing for confiscation of oil or gas produced in violation of laws of the state or valid rules or regulations of state authorities. New conservation act will cut natural-gasoline production in Texas Panhandle 400,000 gal. daily, or 50% of present output.

Ohio Oil Co. and The California Co. open new high-grade oil field on the huge and prominent Medicine Bow structure in Carbon County, Wyoming. Their 1 Kyle discovery well flowed 795 bbl. in 6-hour test of Sundance pay at 5,299-5,391 ft.

10 years ago

May 18, 1950

"Mother Hubbard" antitrust suit filed by United States Department of Justice charges seven major California oil companies with collusion in price fixing and suppression of independents. Conservation Committee of California oil producers also named along with Standard Oil Co. of California, The Texas Co., Shell Oil Co., Tide Water Associated Oil Co., Richfield Oil Corp., General Petroleum Corp., and Union Oil Co.

First third-grade gasoline to be marketed since before World War II goes on sale at several points in the East and South. Esso Standard Oil Co. (Jersey subsidiary) makes new low-grade gasoline available on request on experimental basis to boost sales.

JOURNALLY SPEAKING

Alky-Gas Smog

OLD SOLDIERS may fade away, but old political gimmicks don't. They keep cropping up in a new dress every few years.

Case in point is alky-gas. Now it's being touted as the cure for smog.

Idea is that if automobiles burned alcohol instead of gasoline, the atmosphere in Los Angeles would be a lot safer for the citizens and the atmosphere in the corn belt would be a lot safer for the politicians.

You see, the alcohol would be made out of surplus corn. And a politician doesn't have to be very good at mathematics to figure out that displacing umpteen millions of gallons of gasoline with alcohol made from corn would not only wipe out the corn surplus but start Iowa farmers on a merry cycle of buying more land to raise more corn to fuel more cars to buy more land to raise more corn.

Whether or not this would really eliminate smog we don't know. That angle is a new one on us. But the alky-gas route to farm relief has been kicking around Congress for at least 30 years. And it has always been enshrouded in plenty of political smog.

Now the U. S. Department of Agriculture is flirting with the idea again, and some farm-belt politicians are getting all excited about it.

It is undeniably true that a gasoline engine can be made to run on alcohol, or at least on a mixture of alcohol and gasoline. In fact, a little alcohol in the gasoline improves engine performance under certain conditions.

It is also true that several foreign countries have used alky-gas fuel for many years.

And unquestionably the addition of 5 or 10% of alcohol to all the gasoline consumed in the United States would soon empty the Government's scandalously bulging grain-storage warehouses.

But then we run into the political smog that makes it so difficult for the farm-belt dreamers to see any farther.

Alcohol greedily absorbs water from the air, and on a damp day a tankful of even a 10% mixture might become so waterlogged as to give trouble.

Those foreign countries that used alky-gas not only had surpluses of agricultural products that could be turned into alcohol, but they had no oil of their own and lacked the foreign exchange to import much. Gasoline use was discouraged, and its price was so high that the additional cost of supplementing the supply with alcohol didn't hurt too much.

Alcohol can be made from petroleum a lot cheaper than it can be made from grain or even from waste blackstrap molasses. But even so, petroleum alcohol costs a lot more than gasoline and isn't as good an all-around fuel. If this weren't so the oil industry would have been promoting alky-gas for lo these many years.

So the only way to get motorists to use higher-priced and less-satisfactory alky-gas is for the Government to force them to use it by drastic regulation.

Skipping for the moment the little matter of the constitutionality of such a law, the Government could require that all motor fuel contain whatever percentage of grain alcohol the farm bloc considers desirable. It could exempt the alcohol from the gasoline tax, of course, but this wouldn't be enough to keep the cost down even close to its present level. So either motorists would have to pay a lot more, or the Government would have to subsidize the alcohol plants.

Whether the total cost would be any less than the present types of farm relief is highly debatable.

To be truthful, the Department of Agriculture isn't real hot on alky-gas. It is trying to interest the chemical industry in finding some use for the grain-alcohol plants built during the war to aid the synthetic-rubber program. The plants have been idle ever since because chemicals from petroleum are so much cheaper than those made from grain.

But the mere suggestion is enough to send the farm politicians on another alky gas crusade. We probably will see a lot of their smog right up to election day.

—Henry D. Ralph.

QUALITY
(whatever the grade)

QUANTITY
(whatever the volume)

SERVICE
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WARREN'S FORMULA FOR . . .

DEPENDABLE DELIVERIES OF NATURAL GASOLINE

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EXPORT TERMINALS: CORPUS CHRISTI, PORT ARTHUR, BAYTOWN, TEXAS CITY AND WARRENGAS, HOUSTON, TEXAS, SAN PEDRO, CALIF.

Marketing losses invite a cut in crude prices

THE MAIN THING WRONG with the oil business is the demoralization of the products market. And in affixing the blame for this, suspicion is centering on a handful of integrated companies.

These are companies with crude production substantially equal to their refining capacity. It appears to be the policy of a few of these to refine at near capacity and sell products at prices that show no profits for their manufacturing and marketing departments.

Their reasoning seems to be that their production costs are sufficiently below the posted price of crude to give a margin of profit that offsets other losses. In other words, their producing departments are subsidizing marketing losses and financing price wars.

THIS IS A DANGEROUS and short-sighted policy. Whether it is deliberate (as some industry gossip has it) or simply blundering mismanagement, it could lead to disaster for the companies practicing it as well as for the rest of the industry.

This sort of price competition in the products market puts an intolerable squeeze on all companies that try to show a profit in their refining and marketing departments and particularly on refiners that must buy a substantial portion of their crude from other producers.

Such refiners are not going to take this beating indefinitely. Sooner or later they are going to retaliate by cutting the price they will pay for crude. And their price cuts will not be small or localized.

A big slash in crude prices would put the shoe on the other foot. Then refiners that are big purchasers of crude would have the advantage, and those that produce their own—and all independent producers—would be on the losing end.

A GENERAL CRUDE-PRICE CUT would be a serious blow to most all producers, both independent and integrated. And it would have other far-reaching ramifications.

Producers would demand immediate drastic reductions in all import quotas, and their efforts probably would be successful.

Independent marketers would renew their sporadic demands for disintegration of the industry, or at least for public inspection of accounts to prevent one division of an integrated company from subsidizing another.

It is hard to believe and harder to prove that certain suspect companies are in fact engaged in a purposeful policy of demoralizing the market by deliberately incurring losses in refining and marketing.

But it is a fact that—whatever the causes and motivations—excessive refinery runs, the big volume of distress products on the market, and the paucity of profits in refining and marketing generally are combining to disrupt the industry and threaten an early and deep cut in crude prices.

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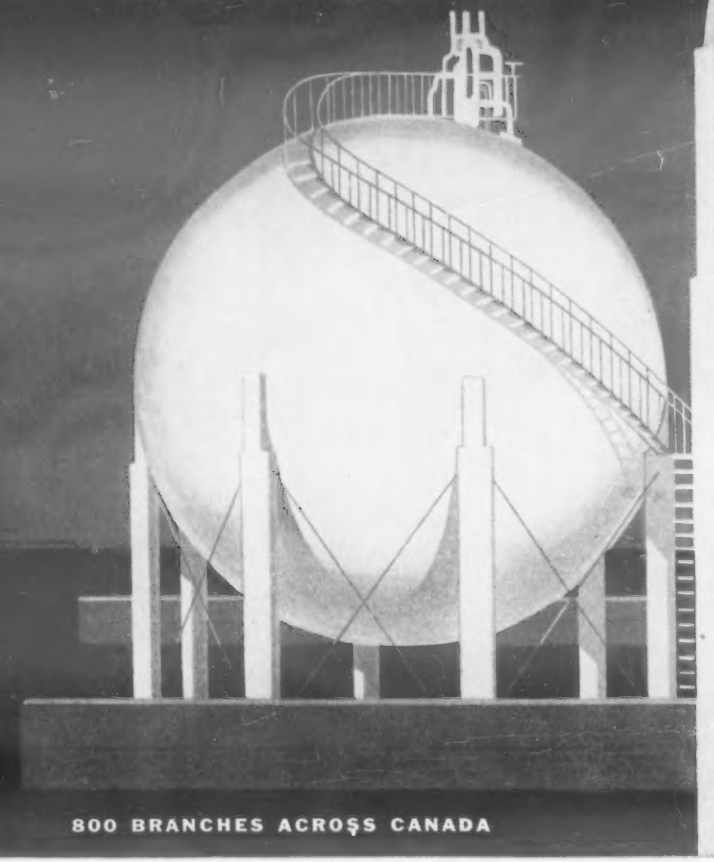

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* "A Guide for Oil & Gas Operators in Canada", 40-page handbook published by the B of M, is yours for the asking. Address John A. Baines, Mgr., Oil & Gas Dept., 140 Eighth Ave. West, Calgary, Alta., Canada—or our nearest U. S. office.

RESOURCES EXCEED $3 BILLION

INTERIOR officials heard independent producers arguments for further import restrictions.

Producers Make Pitch for Imports Cut

● Neither IPAA nor other producer groups appearing in Washington specify just how much imports should be cut—but they agree additional restrictions are necessary to firm up crude prices and increase drilling activity.

DOMESTIC producers made two separate, but related moves last week to spur the federal Government to consider a further reduction in crude-oil imports.

A letter was sent to President Eisenhower by the Independent Petroleum Association of America calling for a review and reevaluation of the level of imports under the mandatory oil import program.

A delegation of spokesmen for other producer groups met with Interior and other administration officials to urge that the flow of imports be reduced to help assure a stronger domestic producing industry.

There was no apparent conflict between the two moves.

In both the IPAA letter to the White House and the oral presentation by the other group at Interior, the key points presented were these:

... **There has been** a marked downturn in producer activity this year, reversing the uptrend that appeared last year after the mandatory program went into effect.

... **Crude-oil prices** have deteriorated, and appear in danger of further declines.

IPAA summed it up this way: There is much evidence that the domestic industry is not "healthy and vigorous."

In the presentation at Interior, spokesman after spokesman cited figures showing the decline in rig activity, geophysical and core-drilling crew activity, the weak crude price structures, and other indications of depressed operations.

Neither group recommended the specific size of a needed cut in imports. Rather, they were urging that government officials in charge of the program give the over-all picture a close study.

Both groups also made it clear that they realize that imports may very well be only a part of the industry's problems. They said they were making an effort to locate and correct other factors but that, meanwhile, they felt the Government should examine the mandatory program to see if adjustments weren't needed which would help end the downturn.

The IPAA presentation centered primarily on the following points:

... **Domestic** crude production this year, although almost the same as in 1959, is expected to average almost 100,000 bbls. daily less than in 1956.

... **Crude prices** have shown a steady decline since 1957 and during the past 15 months more than 1.1 million barrels daily of domestic production have been reduced in price, with cuts ranging from 3 cents to 25 cents a barrel.

... **Geophysical** and core drilling

crew activity has shown a continuous decline for the past 6 years. Moreover, the number of these crews active in the first quarter of this year is down 13% from the same period of 1959.

...Well completions through April 29 this year declined 14% from the same period of last year. If this trend continues, IPAA pointed out, completions in 1960 would total only about 44,000 wells—less than any year since 1950.

...Rotary-rig activity is down 15% from last year's rate during the same period. If continued, this could result in the lowest number of rigs active in any year since 1946.

...Employment is dropping in the oil industry, thereby providing another key indicator that exploration and development activity is declining.

IPAA urged that particular attention be given to the possibility of including Canadian imports in the total over all permissible import level.

In the presentation at Interior, John Hurd, president of the Texas Independent Producers and Royalty Owners Association, used charts to show that the loss of U. S. oil market by Texas producers since 1954 has been paralleled by a gain of U. S. markets by imported crude. (See related story p. 232).

Hurd noted that while the amount of oil supplied by Texas reached a peak of 3.04 million barrels daily in 1956, that total had dropped to 2.73 million barrels daily in the first quarter. Meanwhile, imports, which were 1.05 million barrels daily in 1954 and 1.44 million barrels daily in 1956, had risen to 1.89 million in 1960.

He was challenged mildly on this point by Interior Under Secretary Elmer Bennett, who pointed out that the TIPRO figures had included California. Bennett questioned whether it was realistic to include the California figures since there was little supply of Texas crude to California.

Prices . . . Jack Campbell of New Mexico, secretary of a nation-wide liaison committee of independent oil associations, put considerable emphasis on the need for price stability if the domestic industry is to remain healthy.

Bennett indicated at the meeting's end that he would discuss further with the Office of Civil and Defense Mobilization the possible need for government study of low prices.

Bennett noted that when the mandatory program was set up, President Eisenhower specifically called for constant attention to prices. This was generally considered as a warning against price hikes as a result of import controls. However, Bennett appeared interested in the theory that the Government has an equal responsibility to guard against too low prices which might endanger the domestic industry.

All in all, 16 producer groups from 13 states were represented.

Interior Wants to Revise Import Quotas

- Changes proposed would cut District 1-4 quotas slightly and increase those for West Coast. Refiners using Canadian crude would be protected.

INTERIOR Department last week proposed some adjustments in the sliding-scale percentages used to determine individual import quotas.

The general effect, if the rule is adopted, will be to decrease slightly crude imports into Districts 1-4 while increasing imports into District 5. The new rules would also affect the inclusion of imported Canadian crude in determining an individual import allowable. They would go into effect July 1.

By using the sliding scale, a company can determine what its import quota will be for the next 6-month period because the quotas are tied to a percentage of refinery runs. Refineries with a small throughput of crude get a higher percentage, while larger refineries are assigned a lower percentage figure.

There is one other point to remember in applying the sliding scale in Districts 1-4: The rules provide that a historic importer's quota shall not be less than 75.7% of the last allocation of crude imports he was given under the voluntary program. Therefore, if the application of the above sliding scale results in a quota smaller than 75.7% of his voluntary program imports, an importer can ignore the sliding scale and use the 75.7% figure.

A different sliding scale is proposed for District 5, where a higher rate of imports would be permitted.

How Interior Proposed to Change Import Percentages

Average Runs (Bbl. daily)	DISTRICTS 1-4 Current Per Cent	DISTRICTS 1-4 Proposed Per Cent	DISTRICT 5 Current Per Cent	DISTRICT 5 Proposed Per Cent
0-10,000	13.0	12.3	35.4	45.0
10,000-20,000	11.9	11.3	28.3	36.0
20,000-30,000	10.8	10.2	21.2	26.9
30,000-60,000	9.7	9.2	14.1	17.9
60,000-100,000	8.7	8.2	11.3	14.4
100,000-150,000	7.5	7.1	10.3	13.1
150,000-200,000	6.5	6.1	9.4	11.9
Over 200,000			7.5	9.5
200,000-300,000	5.3	5.1		
300,000 and up	4.3	4.1		

As in Districts 1-4, historic importers in District 5 are provided with a "floor" beneath which their quotas will not drop. For this district, the "floor" is 80% of the last allocation of crude imports an importer had under the voluntary control program. This is an increase over the current percentage, which is 75.5.

Canadian crude . . . In addition to the sliding-scale changes, the proposed rule would require that in computing future allocations based on the last allocation under the voluntary program, the importer would reduce the voluntary quota figure by the average barrels per day of crude oil imported from Canada during the period from September 1, 1958, through March 10, 1959.

This would affect only the amount of crude a refiner could import from other countries, since overland crude imports from Canada remain exempt. And the U. S. refiner who has imported only from Canada would not be affected at all.

The obvious intent is to protect the Canadian supply for U. S. refiners dependent on Canadian crude while at the same time putting some damper on those who are not dependent on Canada as a crude source.

OKLAHOMA scouts now hold one check a week instead of the three in previous years.

Oklahoma Scout Check Cuts Costs

• Cost of obtaining Oklahoma well data has been slashed two-thirds by reducing number of scouts and checks.

STREAMLINING the Oklahoma scout check has cut operation costs 66% in 2 years.

Companies now spend $21,970 a month for Oklahoma well data, compared with a monthly tab of $64,700 just 2 years ago.

The streamlining was ordered by representatives of Oklahoma scout-check in February 1958 after it was decided the operation of assembling well data was too costly and unwieldy.

At that time, 80 scouts from 27 companies participated in three Oklahoma checks at Ardmore, Enid, and Shawnee. It cost the firms $45 monthly dues, plus the cost of maintaining scouts—estimated at $660 a month per scout for salary, travel, and other expenses for 3 days each week.

What's been done . . . The committee made up of representatives from participating companies launched the cost-cutting program by reducing the number of checks and scouts.

In May 1958 the number of checks was cut to two and the number of scouts was reduced to 57. The committee later combined the remaining two weekly checks into one, which now meets each Wednesday in Oklahoma City. Each of 26 companies now has one scout who attends the check.

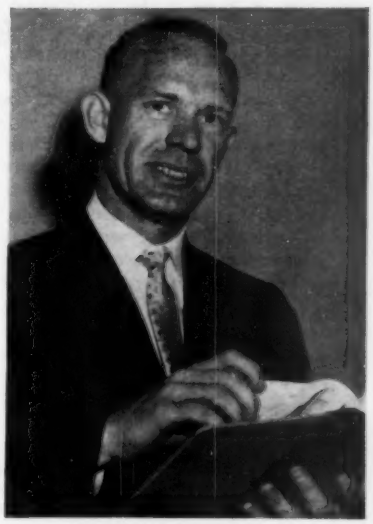
Dues are $85 monthly, but the big savings has resulted from the need of fewer scouts for the check, releasing others for fulltime company assignment.

The check system is a non-profit operation and dues for 2 months were waived in 1959.

Also, the scouts participating in the check now have 2 days a week free for company work. The scouts spend Monday and Tuesday making the rounds of their districts and devote Wednesday to the scout check. They're back at their home bases Thursday and Friday.

Don Hill, Skelly Oil Co., Tulsa, chairman of the scout advisory committee, says time is saved by restricting the oral check to information on wildcat wells only. Data on development wells is distributed in a weekly progress report to the companies.

The Oklahoma system is termed unique by the committee. It has a full-time scout check manager, George M. Dooley, Oklahoma City. Dooley, formerly in record work with Pan American Petroleum Corp., has a part-time staff of four typists and filing clerks.



George M. Dooley
. . . paid scout check manager.

Dooley handles book work, directs assembling, and mailing of data, and

supervises the establishment and filing of permanent records.

A week's schedule in the Oklahoma City scouting office runs about like this:

Monday and Tuesday—New locations, supplied by telephone from scouts, and intentions to drill, obtained from the Oklahoma Corporation Commission, are assembled and checked against well maps for location and pool name. The information is typed and sent to the printer.

Wednesday—The scouts meet to deliver progress cards on development wells and to attend the oral check on wildcats. First report tickets printed from the Monday and Tuesday roundup are distributed to scouts.

Thursday—Completion tickets are sorted and delivered.

Friday—Progress reports are sorted, and delivered by messenger to participating companies.

There are about 100 new completion cards prepared each week, and each company receives copies. The companies also receive a 35 to 45-page report every week containing first reports on wells and any corrections on drilling reports from previous weeks.

All companies maintain their own records, but a permanent record of all data also is kept at the scout-check office. This can be double-checked at any time by participating companies.

In other ways, the organization of the scout check is much the same as in the past.

The scouts elect a scout czar or "bull scout." His duties include calling tickets, assigning districts, and receiving and handling complaints.

A three-man advisory committee of management level serves as a steering committee.

Improved operation . . . The advisory committee believes the new system has increased accuracy of reports and speeded compilation and distribution of data.

"I'm convinced the system is working satisfactorily and that the scouts and companies as well like it," says Hill.

"Under this system, the scout is not tied down by mechanics of taking notes and dictating them into permanent records.

"So far as I know, no scout has lost his job because of the change. On the contrary, I know many who have been assigned to more important and productive jobs doing special scouting, land work, and contact work among leaseholders."

Refiners Need a New Product—

• Today's refineries can make everything conceivable except money; it's time to make it a major, instead of accidental, product, he tells Division of Refining.

M. J. RATHBONE, president of Standard Oil Co. (N. J.) and chairman of the API board of directors, has some definite views on what's wrong with the refining industry.

It's conducting its operations as if it were a proving ground for technical performance and bookkeeping agility.

What's needed is a switch toward making profits a prime product instead of an incidental or accidental byproduct, he told refiners last week in Detroit.

Pointing out that the substantial surpluses in crude producing, transportation, and refining capacity will probably exist for some years to come, Rathbone said the industry continues to stress volume.

"To remain wedded to volume alone as a criterion of performance is sheer folly. Disregarding the true market demand is a luxury no one can afford for long. The 'incremental throughput' philosophy has spread like a virus through our industry.

"The total market demand for our products at any given time is relatively inflexible. Surplus supplies and weak prices do little to create any substantial increase in demand. Incremental throughput doesn't change this fact.

"Little wonder that investors have ceased to regard the oils as one of the prime investment opportunities for growth in value."

What's needed . . . Rathbone offered no "magic formula" but did have three suggestions. These were:

. . . Get a better understanding of oil economics.

. . . Expand demand by either increasing it in current uses or developing entirely new uses.

. . . Participate in API activities on a broader scale.

As for economics, Rathbone said refiners must orient their thinking to the demand of the market.

"We must know what it costs to

Future Gasolines to Need More

RUMBLE and knock, two old road blocks refiners meet in blending today's motor fuels, are going to be harder to avoid in gasolines of the future.

The reason: They go hand-in-hand with increasing compression ratios.

Individually, the two problems could be dealt with fairly easily, and without much added cost. The complication arises from the fact that changes in fuel composition which correct one problem may make the other problem worse.

To get better information on the types of gasolines needed to give best performance in tomorrow's cars, Dupont conducted extensive road and dynamometer tests. Results were reported by W. E. Morris and K. Hyatt at last week's API Division of Refining meeting in Detroit.

Because of the importance of road-octane performance in designing gasolines to satisfy these coming cars, Dupont set out to determine the full-throttle and part-throttle road octane numbers for various possible fuels. Some 71 fuel blends made from 35 components which may be used in gasolines of the future were tested.

Four test cars, a standard and a modified high compression-ratio car of each of two 1959 models, were used. Compression ratios of the standard cars were 10:1 and 10.5:1. Those of the modified models were 12:1 and 13:1. All had V-8 engines and automatic transmissions.

Fuels studied . . . Gasoline blends used covered a range of compositions, including blends of aromatic, olefinic, and paraffinic components.

Individual aromatic and paraffinic hydrocarbons also were included so the results could be used as a guide in assigning values to these hydrocarbons in process research.

. . . Aromatic components tested included several reformates, one of which was a molecular sieved reformate, and another a denormalized Platformate. Four pure aromatics were tested, as well as extracts and narrow cuts of others.

. . . Olefinic components included a C_5 olefin cut, a C_3 polymer, two full-boiling catalytic cracked components, and a light catalytic cracked fuel.

PROFITS—Says API Chairman Rathbone

make high-quality products and judge the prospects for recovering the added costs. We must understand crude values better. We must recognize and adjust to the impact of natural gas on markets for oil, which is having and will continue to have, a profound effect on refinery operations and economics.

"Quicker and more realistic adjustment of refining operations to seasonal demand factors is essential. While we can't do anything about the weather, we certainly can do some things because of it, and we can do them a lot more promptly."

As to profits, he said, "Every refinery should be run with a profit-and-loss statement—and the looks of the profit-and-loss statement should be as important as the unit cost statement if not more so, in judging the effectiveness of refinery operations."

... Expanding demand. If every car traveled another 100 miles a year, U. S. gasoline consumption would rise 1%. Annually, this would mean a 10,000,000-bbl. increase.

So, he suggested, "Let's consider switching our emphasis from the incremental barrel of output to the incremental use of the auto."

M. J. Rathbone
... tells refiners to make money.

In addition to expanding traditional uses, Rathbone said it's even more important to find brand new uses for oil products. As examples of what Jersey Standard research people are doing, he cited:

... Asphalt films applied to farm crops to keep moisture in the soil while seeds are germinating.

... Use of fuel oil and gas as substitutes for coal or coke in the metallurgical industry.

... The hydrocarbon fuel cell shows promise, as also does the use of oil for air conditioners, water heaters, and other household equipment.

"These attempts barely scratch the surface. Imagine what could happen if the research departments of all companies made strong and sustained efforts to find new uses for oil."

API participation . . . This will pay off for refiners who work at it harder, Rathbone said.

"All of us know it costs real money to run the API. Since we are concerned about costs in our own companies, doesn't it make sense to ask if we are getting our money's worth from our investment in API?

"What is really needed is a long, hard look at our current problems, and a willingness to shift the priority of money and effort spent to those problems. Our investment in API can be one of our best if we work to make it so."

Resistance to Rumble, API Refiners Are Told

... Paraffinic components included three light alkylates, three C_5-C_6 mixtures, and several pure paraffins. Components of isomerization products tested were isopentane, 2,3-dimethylbutane, 2,2-dimethylbutane, and methylpentanes.

Test results . . . Morris and Hyatt found there are many ways in which gasolines can be made with knock resistance adequate for cars of appreciably higher compression ratio.

For the aromatic components, increasing reforming severity, using aromatic extracts, and removing normal paraffins with molecular sieves will give road octane improvements which fully reflect the increases in laboratory octane number.

Proper selection of light paraffins can give large improvements in road octane quality. At full-throttle, 2,3-dimethylbutane has a road octane blending value 10 numbers better than isopentane; it was 20 numbers better than conventional C_5-C_6 isomerization products.

Other findings from the octane quality studies were that:

... Part-throttle knock will be critical in some higher-compression cars, just as it is in present cars. Sensitive gasolines will need excess full-throttle road numbers in order to have adequate protection against part-throttle knock in such cars.

... Replacing olefins with paraffinic components can lead to big improvements in part-throttle road octane number. Isopentane was superior to all the olefinic components tested, with a part-throttle blending advantage of more than 10 octane numbers.

Rumble findings . . . The researchers found that an alkylate gives less surface ignition and rumble than a reformate when each is run in the presence of its own deposits.

The effect was generally greater at higher compression ratios. This may mean that the aromatic content of future premium gasolines will have to be limited.

As expected, the tendency to rumble increased with compression ratio. However, increases in compression ratio didn't significantly affect the amount or severity of surface ignition. Thus, they concluded, less surface is required to cause rumble in the higher compression-ratio cars. Changes in combustion chamber design or engine structural changes may ease the problem.

Two other views resulting from the program were that:

... Removing highest boiling fractions may be beneficial. In present-day cars, the effect was marginal with the reformate tested. It was doubted that limiting reformate end points can now be justified economically for surface ignition considerations alone. But as compression ratios increase, the situation may change.

Limiting the end point of the reformate used in one high compression-ratio car cut down surface ignition. The reduction in rumble was negligible, however.

... Changing fuel composition to increase resistance to ignition by deposits is not a promising way to control rumble. Extremes of hydrocarbon types showed no significant differences in surface ignition or rumble when rated in the presence of standard deposits.

SUBCOMMITTEE Chairman Oren Harris gets ready to open hearings concerning FPC practices.

FPC Probe Gets Off to a Slow Start

• Little is learned as hearings over Corcoran incident open. One thing is obvious—the FPC is swamped with work. Hearings may be a blessing in disguise since subcommittee chairman pledges to try and get agency more money.

THE congressional investigation of Federal Power Commission activities got off to a slow, tedious, and undramatic start last week.

Most of the first days of hearings before the House legislative oversight subcommittee were spent in detailed questioning of FPC Chairman Jerome Kuykendall.

About all this questioning revealed was something the gas industry knows all too well: There is a log jam of cases at the commission causing long delays in the settlement of certifications and rate matters.

Toward the week's end, after the questioning of Kuykendall had finally ended, the committee was scheduled to hear from Commissioners William Connole and Arthur Kline.

And Thomas G. Corcoran, attorney for Tennessee Gas Transmission Co., was to be questioned about his contacts with the FPC in the Midwestern case last fall.

The aim of that questioning would be to determine whether Corcoran's contacts caused the commission to switch its views on a rate of return the pipeline company should get.

After Corcoran, the subcommittee was to hear Gardiner Symonds, chairman of the board of TGT, and N. W. Freeman, president of Midwestern Gas Transmission Co.

Symonds was asked to appear before the committee because of a public statement he issued recently in which he defended the company's and Corcoran's actions in the Midwestern case on the grounds that what was done in that instance—private contacts with members of the commission—was accepted practice engaged in by many firms.

After Symonds, other gas-company officials will be asked about this point because Kuykendall has testified flatly that Corcoran's actions were not "accepted practice" at the FPC.

All of this obviously is going to take time. And from the plodding pace of the first 2 days, it seemed evident that the hearings may drag on for many days—even for weeks.

FPC Chairman Kuykendall
. . . he's trying to put out the fire.

Purpose of hearing . . . Rep. Oren Harris (D.-Ark.), chairman of the subcommittee, said at the outset that the group's purpose was to dig deeper into FPC's functioning, particularly into the matter of "ex parte" representations made privately in cases before the commission and into the question of whether pipeline companies sometimes pay huge fees to attorneys which are eventually passed along to the consumer to pay through higher gas rates.

The subcommittee's counsel, Robert Lishman, followed this pattern in his line of questioning in the early stages of the hearing.

He also brought up the matter of settlements which the commission and companies sometimes make to dispose of a case, indicating that in some instances at least the companies benefit from such settlements.

Kuykendall explained that settlements are used where possible in an effort to speed up disposition of cases

and trim the heavy backlog of work.

Lishman spent considerable time, too, in trying to bring out that attorney fees are passed along to the consumer because they are included in a company's rate base.

Kuykendall repeatedly tried to explain that some normal legal fees are sometimes included in rate cases, but that they are subject to scrutiny and that in some instances they are either trimmed down or eliminated.

Furthermore, he pointed out, after a company's rate is established, any special fees for attorneys would have to come out of company profits because they would not be a part of the rate base and therefore could not be passed along to consumers.

A benefit . . . One possible benefit, from the industry's point of view, which may develop from the hearing is that the detailed questioning on FPC procedure may help to educate some congressmen, newspaper reporters, and others on the problems at the FPC.

Kuykendall himself readily conceded that the commission is waging a losing fight against the pileup of cases.

"We literally have a raging fire going and we are using every possible means to handle this thing," he said. "It's a terrible situation and we have done everything we can think of. We have asked for more appropriations."

Congressman Harris said he planned to make it a number one project to obtain more funds for the FPC so that it can handle the backlog of cases.

"I'm going to the budget bureau and the appropriations committee myself to see if we can't get the money to get the work done," he said.

Texas Gas-Tax Ruling Sticks

OPERATORS engaged in gas-cycling in Texas must pay the state gas-production tax on the gas they produce during the "blowdown" phase when cycling is stopped as no longer economic.

The Texas Supreme Court has backed such findings by two lower courts in a case fought all the way to the top court by Francitas Gas Co. Francitas contended that it should not have to pay taxes on the gas produced after cycling because it had continuously paid taxes on the liquids extracted from the gas during cycling.

The company had paid $121,878 in gas taxes under protest since July 1950. The money has been held in escrow by the state.

The case was regarded an important one to the state in view of the large number of other fields in which cycling is carried out in Texas.

watching WASHINGTON

Clyde La Motte

ALTHOUGH the spotlight in Washington last week was primarily on the congressional probe of the Federal Power Commission (p. 96) and the appearance of producer groups at Interior Department to seek further reduction in oil imports (p. 91), there were other oil developments in the capital worth noting:

. . . Residual interest. There can be little doubt that the coal industry intends to have a voice in decisions affecting the oil import-control program. For instance, after Interior had announced its plan to put residual fuel-oil import allocations on a 3-month instead of a 6-month basis, it received hundreds of comments. And all of these comments except seven were from the coal industry, not the oil industry.

The outpouring of coal sentiment on this oil issue had the earmarks of an organized campaign, apparently based on the old Washington adage that the squeaking wheel is the one that gets the political grease, especially in an election year.

. . . Automated tankers? The Maritime Administration has signed a study contract with the Norden Division of United Aircraft Corp. to explore the possibilities of controlling and steering ships at sea by automatic controls.

Maritime concedes that the idea of a crewless ship sailing the open sea appears to be a bit far-fetched. But it is convinced that a semi-automated ship might prove practical, with many of the manual and routine tasks handled by mechanization. The purpose would be to help reduce manpower costs.

. . . Please omit flowers. The Independent Petroleum Association of America has quietly buried its campaign for a natural-gas bill in 1960.

. . . Pre-merger notification. The Securities Exchange Commission is still considering adopting a proposed rule which would require companies to report to it any action taken toward a merger with or acquisition of another firm. Although the proposed rule has been opposed by industry, SEC officials claim it would reduce merger rumors which can affect stock values.

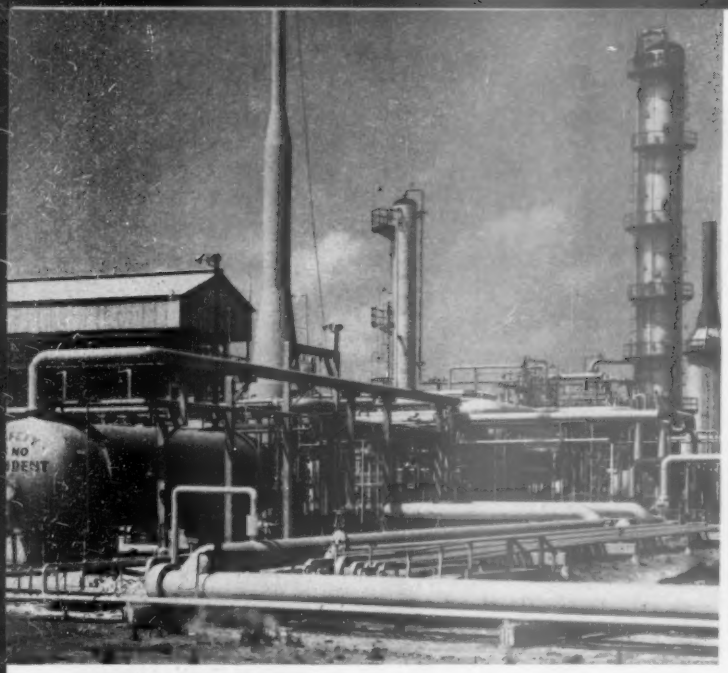
. . . Gulf Oil Corp. suit. A preliminary hearing will be held in a Washington court this week on Gulf's legal protest over its residual-fuel import allocation. The Government's defense will be based chiefly on two points: That Gulf has been doing all right financially under the program, and that Gulf's proposal to tie residual allocations to domestic sales instead of to base period imports is not feasible.

. . . Import appeals. The Oil Import Appeals Board has turned down 14 more appeals for new or increased import allocations, thus maintaining its almost unbroken string of rejections. The grounds on which the board considers appeals is whether or not a company is suffering undue hardship because of mandatory controls. Based on the rulings to date, a company would have to appear in financial tatters and rags to convince the board.

. . . Petition. The Green River Basin Corp. has renewed its petition to the Federal Power Commission to give producers of the Green River Basin an opportunity to share the pipeline profits from natural gas produced there.

The FPC had rejected an earlier petition (OGJ, May 2, p. 81) because the petition was presented in connection with a case on which hearings had already been held. Too, Green River Basin Corp. was not an intervenor in that case.

The new petition, submitted under a different FPC provision, probably will be accepted by the FPC for consideration of the company's view that the high cost of gas production there makes it important for producers to have an opportunity to get in on pipeline revenues.



POLYOLEFIN unit at Humble's Baytown refinery is now turning out polypropylene in commercial quantities.

HOT polypropylene looks like strings of spaghetti. It is cooled and chopped into pellets.

Humble Opens Big Polypropylene Unit

• It's betting $30 million on the future of this new polyolefin in starting operations at the world's biggest polypropylene plant. Capacity of 40 million pounds can be jumped to 100 million as demand develops.

HUMBLE Oil & Refining Co. last week formally opened its new $30-million, 40-million-pound per year polypropylene plant at Baytown.

The plant brings continuous processing to polypropylene and heralds Humble's entry into plastics.

Humble is enthusiastic about the product's future. Because of its low density, says Humble, a pound of polypropylene goes further than the same amount of polyethylene. There appears to be an almost unlimited future market for plastics, and polypropylene should capture a good share of it.

It has been available commercially for about 2½ years. As yet, only five companies are producing it commercially or semicommercially, although several others are either building plants or planning them.

Polypropylene is a new member of the polyolefin family of plastics. It's a chemical cousin of polyethylene, the first polyolefin to reach commercial production.

Polypropylene rates higher than the newest high density of linear polyethylenes, in rigidity, stress cracking, and heat resistance, Humble says.

A prime advantage of polypropylene is its high softening point, 290° F., and its high melting point, 335° F. It is a thermoplastic, which means that it melts under heat and pressure and solidifies on cooling.

The plant . . . Humble calls it a polyolefin unit because in the future it expects to use the plant for making a number of petroleum-based plastics. Polypropylene is the first.

The Baytown polyolefin unit is the largest of its type in the world, Humble says. It covers an area of about three city blocks and is located near the butyl-rubber plant, the only other solid petrochemical made at Baytown.

Initial capacity is 40,000,000 lb. annually, but the unit has the basic facilities for expansion to 100,000,000 lb. annually.

The unit represents an investment of more than $30,000,000, including research and development costs of $15,000,000. The unit was built by Humble employes.

The process . . . The plant converts propylene, a gas at normal conditions, into clear, miniature pellets of polypropylene. In addition to the continuous processing feature, an improved catalyst invented by Esso Research chemists is a key aspect.

The new plant also employs many unusual process and design features.

The production of polypropylene has three basic steps—polymerization, purification, and extrusion. High purity propylene gas, liquefied under pressure, flows into the polymerization chambers.

There, in the presence of catalyst and under carefully controlled conditions of temperature and pressure, it changes into polypropylene. As many as 5,000 molecules of propylene may fuse to form a single polypropylene molecule.

After polymerization, the polypropylene leaves the chambers as part of a slurry. The slurry is filtered and dried to leave fine crystals of polypropylene that look like white powdered sugar.

The powder is then heated and placed into extruders. The big extruders squeeze the plastic out, much like toothpaste from a tube. The many continuous strands from the extruder are cooled, chopped into pellets, and sent to storage bins.

After passing quality control tests it is sent to other storage bins for

packaging in 50-lb. bags. It is being marketed under the trade name of Escon by Enjay Chemical Co., which on May 31 will become a division of Humble Oil & Refining Co.

Enjay Research laboratories in New Jersey will provide technical service for Humble's polypropylene customers.

At Baytown a pilot plant will assist in solving plant problems and improving the plastic.

The background . . . Humble's commercial interest in polyolefin plastics began in 1954. That year, Dr. Karl Ziegler of Germany discovered a low-pressure catalyst system to produce polyethylene. His new method was more economical and the plastic seemed tougher and more heat resistant than similar varieties.

Esso Research bought a license on Ziegler's catalyst system to produce polyethylene.

A three-pronged research and development program was started at the chemicals research division of Esso Research Center at Linden, N. J., at Esso labs in Baton Rouge, and at Humble's Baytown research center.

After bench-scale work at Esso Research Center, a 100-lb. per day pilot plant was built at Baton Rouge. With the added knowledge, a second pilot plant of 1-ton per day was built at Baton Rouge. The 1-ton plant produced polypropylene for market development and provided much of the final engineering data for Esso Research to design the Baytown unit.

Twenty-five percent of Jersey's $70 million research budget has gone into chemical manufacture with polypropylene receiving top priority the last few years.

Jersey first entered the petrochemical field in 1918 and now has $300 million invested in plants and equipment and is planning to invest at least $100 million more in the next two years.

Revenue from petrochemicals last year was more than $250 million, a 35% increase over the previous year, and Jersey expects 1960 to be even better.

Polyisoprene: New Market for Oil

• This new product, synthesized from petroleum, could take a 25% chunk of the natural-rubber market in 2 years. It's as good, and it's much cheaper.

THE OIL industry is moving quickly to capture another market—the one now held by natural rubber.

The product in the spotlight is polyisoprene, a synthetic oil-based material almost identical to natural rubber and much cheaper.

Present production is only 5 tons a day, but plants already building or planned will boost this to 108,550 long tons a year.

Polyisoprene's qualities—and price—are such that Shell Chemical Co. last week disclosed it will treble its planned production.

Shell is now building the first big commercial polyisoprene plant at Torrance, Calif. It's capacity will be 17,850 long tons a year when it goes on stream this autumn.

Last week Shell announced it will build a plant exactly twice that size at a yet-to-be-named midwestern location. It will get its raw material from Shell's Wood River, Ill., refinery.

Two other companies are entering the field commercially.

Goodrich-Gulf Chemicals plans to build a 25,000-ton plant for completion in 1961.

Firestone Tire & Rubber Co. plans to complete a 30,000-ton plant at Orange, Tex., late this year.

Three other companies may soon be in the field. Goodyear Tire & Rubber Co. has a pilot plant in operation at Akron. U. S. Rubber is reported considering a polyisoprene plant, and Humble Oil & Refining Co. is known to have produced small quantities at its Baytown butadiene plant.

What it is . . . Polyisoprene is a product of the polymerization of isoprene, a hydrocarbon that can be converted from the C_6 stream of a refinery.

Isoprene is present in refinery streams but in such minute quantities that its recovery is impractical. To date the companies have been quite secretive about their specific charge stock in isoprene manufacture.

The new synthetic has several advantages. According to Shell Chemical's H. R. Nebeker, polyisoprene:

. . . **Has excellent color** characteristics. These make it an ideal raw material for use in various white and light-colored rubber stocks.

. . . **Can be processed** in a manner similar to natural rubber. Its tear resistence under some conditions is equal to natural and under other conditions, superior.

. . . **Has shown advantages** over natural in molded products. Good flow can be obtained at lower pressure or temperature, and there is excellent detailing.

The market . . . Since polyisoprene is virtually identical to natural rubber, yet costs roughly 30 cents a pound, compared to natural's 38 to more than 40 cents, it could replace natural rubber as it becomes available.

During the first quarter of this year the U. S. consumed rubber at a yearly rate of 560,000 tons. On this basis, the planned capacity of polyisoprene could displace 25% of the domestic market for natural rubber.

If this capacity materializes, it will make this newcomer the third largest of the general classes among synthetic rubbers. Ahead of it would be the S-type rubbers, now being produced at a rate of about 1,285,000 tons a year, and neoprene at 140,000 tons a year.

Present commercial production is limited to 5 tons a day being produced by Shell at Torrance.

Most of this goes to U. S. Rubber, which has been putting it in tires since March of last year and has produced more than 300,000.

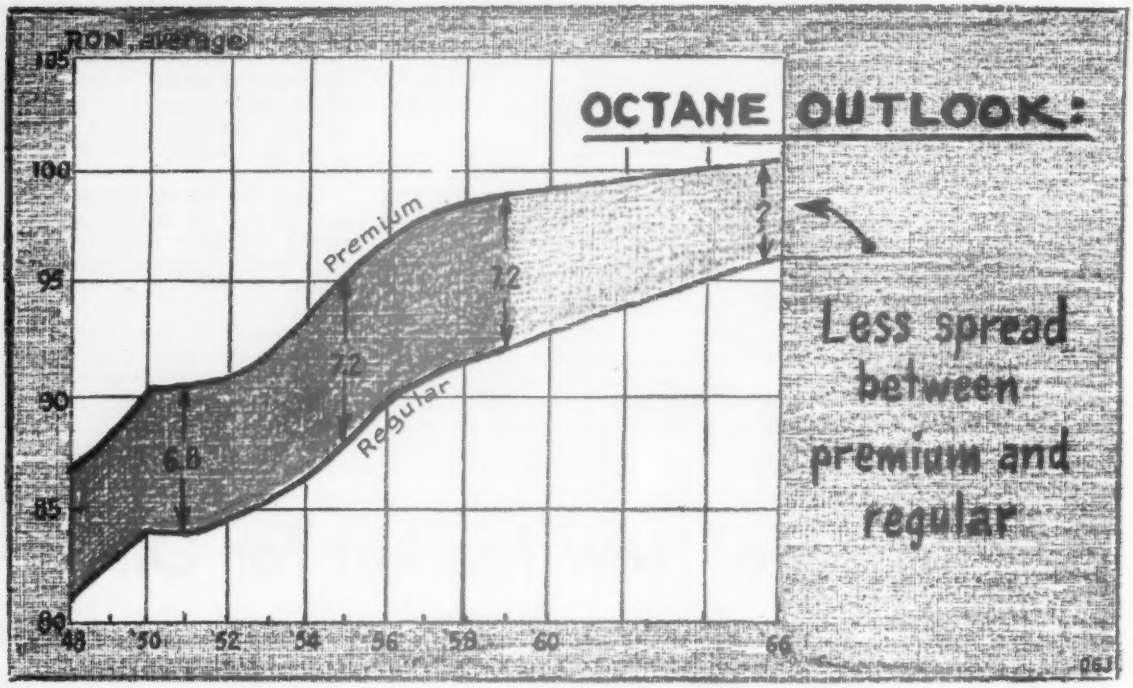
U. S. Rubber's current output of 2,000 such tires a day is limited by availability of the synthetic.

Competitor . . . Even before it gets into full-scale production, polyisoprene could have a strong competitor for the natural-rubber market.

This could come from polybutadiene, a close cousin which is made from the refinery's C_4 stream. Principal difference in the polymerization is the catalyst used and the operating conditions.

In fact, in Goodrich-Gulf's original announcement of its new plant, the company said it would be designed to produce polyisoprene or polybutadiene interchangeably.

Phillips Petroleum Co. now manufactures polybutadiene on a small scale at Borger, Tex., and is expanding capacity to 20,000 tons.



What Refiners Face Down the Road

• Auto makers' switched emphasis from high-power to economy cars means some major changes in gasoline trends. For one thing, regular is expected to take center stage away from premium.

John P. O'Donnell
District Editor

DETROIT'S big change in car design may well bring an equally big change in gasoline manufacture.

The car makers have done an almost complete about-face on power. As a result, some major adjustments in making gasoline appear in the making. The new trends may turn out to be just the opposite of trends in recent years.

Here's what appears to be in the cards:

... Regular will get the big emphasis. Average quality is expected to increase by a full octane number a year for the next few years.

... Premium will lag. Average quality of premium gasoline has increased about 1 Research number a year for the past 10 years. During the next several years, the gain is expected to be only a small fraction of a number each year. As a result, the spread between regular and premium, fairly consistent during the 1950's, will narrow steadily.

... Pool octanes will continue to rise. But, because of a slowdown in premium's increase, the rate of gain for all gasoline will be lower than in the past decade.

... More TEL will be used. Its use in regular has dropped sharply in the past 5 years. But, it's still the cheapest way to get octanes, and certainly more will be used in regular, and probably in premium.

... More severity in processing. Refiners are generally overbuilt for both quantity and quality. They could produce more gasoline and better quality at the same time.

Operating at greater reforming severity would compete with additional use of TEL, but it is less costly, to a point, than adding new processes. It's a route that refiners with built-in, but unused, quality will take.

More severity, however, means a greater spread between Research and Motor octanes. Sometimes this results in less road gain, particularly in commercial vehicles, than would be expected.

Behind the change . . . Detroit's preoccupation with economy is the basic cause of this pronounced switch. This trend has been most evident with the compacts. But they are not the whole story.

Even more significant are the "intermediates," Dodge's Dart and Ford's Comet, the Chevrolet, Ford, and Plymouth sixes, and the economy models of a number of the medium-priced cars.

It now appears that the compacts will make up about 25% of this model year's sales. Others in the economy category are expected to account for possibly 50% of the 1960 model sales. Thus, 75% of this year's cars will be in the economy class or regular-grade category.

This is a drastic switch from 2 years ago. In the 1958 model year, more than 50% of the cars were designed for premium. It was the fourth successive year of a sharp climb that saw the percentage of "premium" cars go from around 25% to more than 50%.

That year 1958 was one of superlatives. Compression ratios and horsepower were at the highest point in history. Imports of foreign cars set

a new record. And sales of U. S.-made cars fell to the lowest point in 6 years.

Failure of the high-powered cars to sell and the success of the imports started Detroit on its current economy kick. Last year sales of cars requiring premium dropped to less than 35% of the total. This year it's dropping further to an estimated 25%.

Next year it may go even further. There will be more economy cars in the Dart-Comet category as more and more medium-priced makes come out with smaller, lighter, lower-requirement models.

With their attention centered on economy models, automobile manufacturers are not expected to devote much time or money to increasing compression ratios of the high compression-ratio cars in the immediate future as they had been doing in the recent past.

There is another good reason why manufacturers will be content to hold the line on high-requirement cars. These high-requirement cars have encountered ignition problems, such as rumble. Phosphorous additives have been helpful in counteracting rumble but they are not a panacea. And, until this problem is solved, the incentive to push for greater power via higher compression ratios is greatly reduced.

Between the concentration on economy and the ignition problems that go with high compression, there is good reason to believe that Cadillac's 10.5:1 ratio will represent the high for some time to come. There may be some options like Pontiac's 10.75:1, but it's doubtful if any standard ratio will go up very much in the next few years.

Premium . . . A slowing down here is already apparent. From April 1959 to April 1960 average premium quality moved up 0.3 octane. The corresponding period the year before it rose 0.6 octane, and it rose 0.8 octane the year before that.

Even the past year's gain of 0.3 octane may look pretty big in the near future. Some observers see annual gains in the next few years for premium of no more than 0.2 octane. If these guesses are sound, it will be 2 years before average premium quality hits the magic 100 Research octane for the U. S.

This could be a blessing in disguise. The industry has yet to devise a sure way to measure quality above 100 octane. As a result it's almost a sure thing that some refiners are giving away quality.

Regular . . . Quality of regular is expected to go up as fast as it did this past year and maybe even faster in the next few years, probably close to an octane per year.

Regular, in contrast to premium, has shown a tendency to improve at a sharp rate in the past few years. Its gain from April 1959 to April 1960 was 0.7 octane. The previous year's gain was 0.6 octane, and from April 1957 to April 1958 there was a 0.5-octane gain.

Pool octanes . . . Despite the probability of a sharp slowdown in rate of increase in premium quality, there should be a much smaller reduction in the rate of increase for pool octanes. The big reason is that regular gasoline sales more than double premium. Thus, a gain of 0.1 number in regular would more than offset a 0.2 drop in premium.

The average of all gasoline, the "pool," is now about 94.5 RON. This is based on the 1959 breakdown between premium and regular. Premium sales in 1959 represented 31.7% of total gasoline sales and regular, 68.3%. This is considerably different than service-station sales alone, where the breakdown was closer to 53% regular and 47% premium.

More TEL . . . One likely way for refiners to improve quality is greater use of TEL, especially in regular.

The big increases both in quantity and quality of downstream processing have given refiners more than enough quality product to meet today's requirements. One result has been a reduction in dependence on TEL.

There are at least two good reasons why TEL should get a better play in the future. First, it's a relatively cheap way to get octanes, particularly in regular. Second, TEL has been found to give a bonus effect on increasingly important road octanes.

Today's average regular, 92.4 RON, could be increased 1 octane number with the addition of more TEL at a cost of 4 to 5 cents a barrel.

Some refiners already have recognized this possibility. This is indicated by the increase in the average TEL content. There is more dramatic evidence in individual instances. Quite a few refiners have taken advantage of the relaxed restrictions on the use of TEL and have gone well above the old limit of 3 ml/gal.

This is what TEL can do: When added to a large number of premium gasolines the extra milliliter above 3.0 averaged 0.7 octane improvement by Research, 0.9 by Motor, and 1.2 octane on the road.

More severity . . . In recent years considerable reforming and alkylation capacity have been added in U. S. refineries. This has added more to the high-octane potential of the industry than necessary to meet demand.

This potential has been augmented for motor fuel by the drop in avgas demand. Domestic avgas demand was 81.5 million barrels in 1958. Last year it dropped to 76.5 million barrels. At the same time production of alkylate, a critical quality component of avgas, has gone up. It went from 26 million barrels in 1958 to 34.9 million barrels in 1959, an increase of almost 35%.

With demand for avgas going down and with production of its major quality component going up, large quantities of alkylate have been released for use in motor fuel.

One dramatic indication of alkylate's increased availability showed up in a recent survey. It showed one sample of superpremium with a higher Motor than Research rating. In effect, it had a minus sensitivity. It is almost certain that this was accomplished by the use of a large percentage of alkylate.

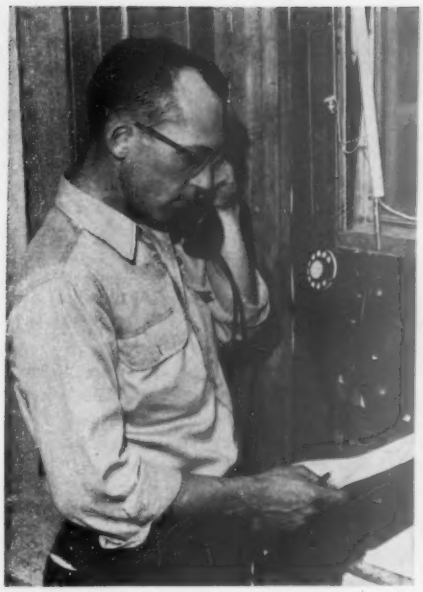
The unused potential of available refining processes in the U. S. is sufficient, it is believed, to add at least 2 and possibly 3 octane numbers to the gasoline pool. Pool octanes would go up nearly 2 numbers if 1 octane were added to premium and 2 to regular.

This could be accomplished by maximum use of the country's reforming capacity. Higher octane product would be available, too, through judicious use of reduced yields in reforming and more anti-knocks. Reforming severity alone could add an octane, but its cost would be another matter.

Refiners' views . . . The prospect of more regular and less premium is not appealing to refiners.

Just as some automobile makers were sorry to see public demand swing from the more profitable standard makes to the less profitable compacts, so would many refiners hate to see demand switch from more profitable premium to less profitable regular. It won't happen as fast in oil as it did in cars because the public's taste in motor fuels does not change that fast. But a change does appear to be in the making.

It's a distasteful prospect, but it could be tempered by one thing. If the proportion of regular does go up and premium down, the latter will be less costly and easier to make. It's quite possible then that premium would remain as profitable as ever, even if it does lose some of its share of the over-all gasoline market.



1 At take-off, truck driver calls dispatcher at Chicago to make sure product needed is flowing in pipeline.

2 Pipeline dispatcher releases motor-operated valve at Trenton by dialing remote-control telephone code number. This permits the truck driver at take-off terminal to load directly from pipeline.

5 Overall view of Indiana Standard's key-stop tankless take-off in operation near Trenton, Mo. It's termed an innovation in petroleum-product distribution.

Key-Stop: Turn the Key and Load Up

STANDARD Oil Co. (Ind.) has found the key—literally and figuratively—to loading gasoline or heating oils directly from underground pipelines.

It's a key-stop take-off, which eliminates expensive storage tanks. Indiana Standard has completed a year's pilot operations at the first such tankless take-off at Trenton, Mo.

The automated terminal design features remote control of take-off valves. The remote control is coupled with local control of loading by the truck driver, who operates the loading valve and its meter by key.

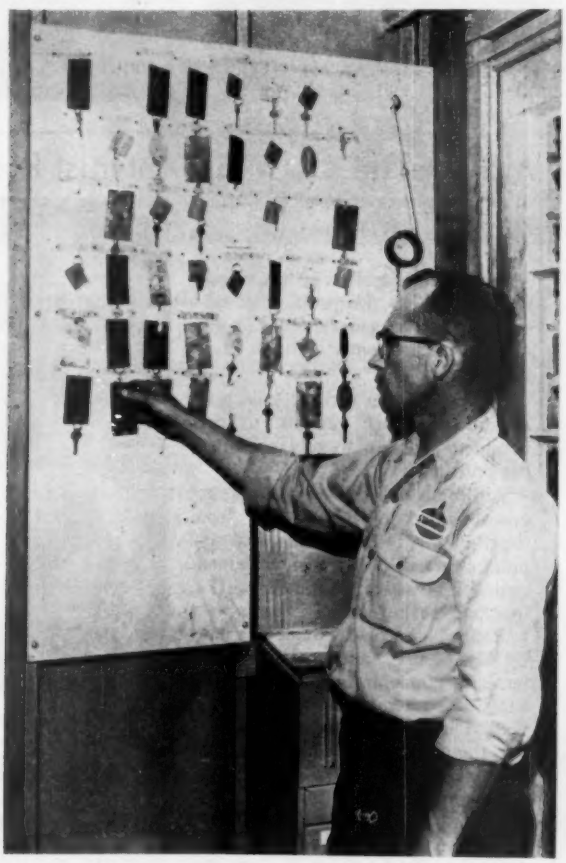
F. Cushing Smith, general manager of supply and transportation for Indiana Standard, says the need for storage tanks is eliminated since the tank trucks load from the pipeline as the product flows by. This enables the tank trucks to supply nearby bulk plants more economically, Smith adds.

The company is planning three additional tankless terminals this year, one near St. Joseph, Mo., and two in Michigan, near Constantine and near Girard. A modified key-stop also is planned for Cedar Rapids, Iowa.

3 Driver unlocks key-operated control which permits dispatcher to dial open the valve for desired product. Valve closes automatically after filling.

4 Inserting delivery ticket into printing meter is required of transport driver before taking the load of product from the pipeline.

6 After loading from pipeline is completed, flash point of each load of heating oil is tested by the truck driver before transport leaves the terminal.



7 Transport driver picks up key to unlock bulk plant at his destination. This key-stop method permits unloading in absence of bulk-station agent.

Compacts Under Study

. . . but there's no agreement yet on their economy for big companies operating large automotive fleets, AGA learns.

FIVE large companies which operate fleets of passenger cars have turned in their reports on compacts.

The verdict: Mixed.

Some companies want more time to judge their merits. But no one has said thumbs down, and some are enthusiastic.

This appraisal of the compacts occured at an unusual off-the-record panel discussion held at the distribution and transmission conference of the American Gas Association in New Orleans last week.

The speakers represented five large utilities in New York, Pennsylvania, Illinois, New Jersey, and Missouri. All have tried compacts and kept close records on mileage, maintenance, initial cost, etc.

One company disclosed it has bought 200 compacts and is preparing to add another 600 if the 1960 performance meets expectations. Other companies are more wary, and one has serious doubts it will save anything at all.

The companies had a wide variance in mileage experience—from as low as 10.8 miles per gallon to as high as 18. The great difference, they decided, may be explained partially by the ability of the drivers to handle them properly.

Company A . . . The company which had serious reservations about the compacts found it would buy them for $200 to $250 less than regulars but feared it will lose much of this advantage on resale, especially if the compact loses favor with the public.

While some of the compacts of this company made 17 mpg., those assigned to the "work group" made only 13.83, compared with 13.78 mpg. for standard cars. The company figured its total yearly saving would come to $57 per car, and this could be wiped out in the fifth and sixth years of the car's life if repairs were heavy.

Company B . . . This company failed to find any difference in mileage between the Rambler and Lark compacts and the Ford and Chevrolet, although the testing was limited. The only appreciable difference, so far, has been a savings of $300 on initial price.

The company, however, has bought another dozen Larks and a dozen Falcons and admits "we don't know what the results will be."

Company C . . . This company had bad luck with first compacts—the foreign Anglia—but turned up with good results on its first Ramblers and Larks.

Spare parts were hard to get for the Anglias, and the company is replacing at least 12 of the 18 purchased.

The first quarter's experience on the company fleet showed the operating expense on the Rambler American to be the least, with the Lark second, the regular Rambler third, the Anglia fourth, the Ford fifth, and the Plymouth sixth.

However, the company pointed out that it was comparing Fords and Plymouths that were 3 to 4 years old with the newly bought compacts. Nonetheless, the experience so far has encouraged the company to make plans for buying 218 Falcons, Larks, Ramblers, and Valiants and to fill 95% of its new-car requirements for 1961 with compacts.

Company D . . . A fourth company reported that its brief experience with compacts has convinced it that a saving of $450 can be expected over the life of each car.

Mileage has hit 16.81 mpg., compared with 12 mpg. for regular cars. This company favors the Falcon but said it bought Valiants too late to get a clear experience test. The Corvair was unsatisfactory because its irregular trunk was not suited to company needs, and the mileage did not match the Falcon's.

Company E . . . The last company on the panel has gone furthest with the compacts. It will buy up to 800 of them if the 1960 maintenance figures are satisfactory.

The company started out by buying one each of the Corvair, Falcon, Lark, Valiant, and Rambler American. It kept records and required drivers to fill out performance questionaires. It now owns 53 compacts, has 38 on order, and expects to have 200 by the end of the year.

It was found they cost $200 less than regular cars, and this saving will amount, therefore, to $40,000 for the 200 cars this year. If the compacts get 5 mpg. more than the regular cars—which the company expects—it will save another $18,000.

Merger Foe Gets Top Antitrust Post

ROBERT A. BICKS is now, officially, the Government's chief trust buster.

President Eisenhower has nominated Bicks to the position of assistant attorney general to head the Justice Department's antitrust division.

Bicks has been serving as acting assistant attorney general, so the President's action merely solidifies his position.

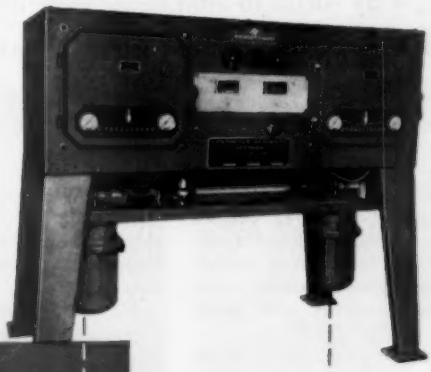
Although there has been some grumbling about Bicks being "too tough," it isn't likely that his appointment will face much open opposition when it comes before the Senate for confirmation.

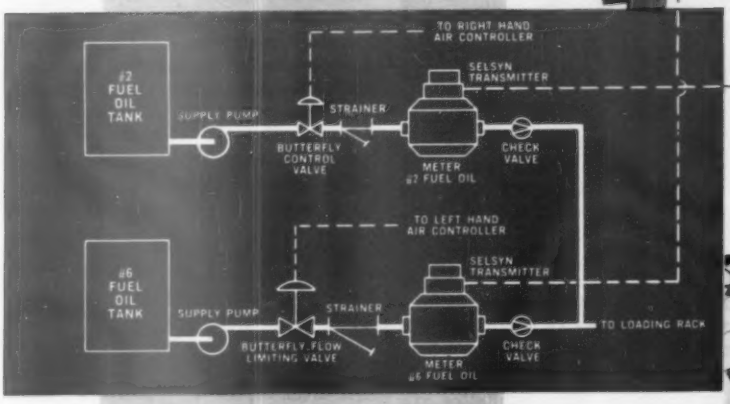
Bicks has already made it clear by his earlier actions that he intends to concentrate on antimerger cases. He already has been instrumental in blocking several, including the proposed Texaco-Superior merger.

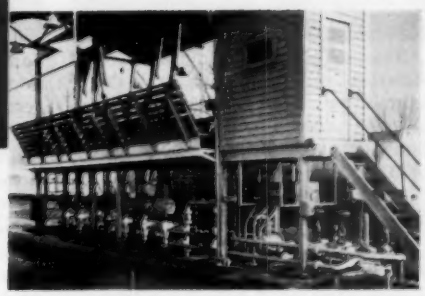
ROBERT A. BICKS
. . . chief trust buster

His reason for singling out mergers as a special target, particularly in the oil industry, is this: He thinks the best way to keep the industry competitive—and he thinks it is competitive now—is to guard against mergers which would tend to cause the oil industry to fall into the pattern of highly concentrated industries, such as steel and automobile (OGJ, Oct. 5, 1959, p. 97).

ONE BLENDER REPLACES INTERMEDIATE TANKAGE







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Small-Tract Compromise

. . . sought by Alcoa to limit losses laid to town-lot drilling in Carancahua Beach and Port Alto, Texas.

VICTIMS of tiny-tract drilling in Texas have received little relief from their barrage of court actions in the past year.

In all suits to date, the courts have uniformly upheld drilling permits issued by the Texas Railroad Commission. And they have just as steadily upheld the commission's static proration formulas for fields with small-tract wells.

These formulas — which dispense allowable 50% on acreage and 50% on the well for oil pools, two-thirds acreage and one-third well for gas-fields—admittedly permit small-tract wells to produce far more than the hydrocarbons in place.

Some operators, whose properties are being bled by offsetting small-tract wells and who are tired of beating their heads against the thick legal wall, are ready to compromise.

Two such are Aluminum Co. of America and Crown Central Petroleum Corp. Leases of Alcoa and its partners, according to their calculations, originally boasted about 84.4% or 350.9 billion cubic feet of the gas in place in the multipay Appling field of Jackson and Calhoun counties.

There are now 22 small-tract wells with 46 completions in Appling producing from town lots in Carancahua Beach and Port Alto. Alcoa contends these wells are draining off its group's reserves at a rate which, if projected, will permit the company to produce only about 263.9 billion cubic feet.

The Alcoa group's suffering likely will not end there, however. A study by company engineers shows that there are 198 more town lots in the two communities.

If a total of only 100 is eventually drilled, Alcoa argues, its projected gas recovery from the field would shrink to only 58.3% of original in-place reserves.

"Confiscation allowable" . . . This depressing picture has led Alcoa and its partners to seek a change of rules for Appling.

The change would recognize a small-tract well's right to produce under the current two-thirds acreage, one-third well formula—but it would restrict that right to just one zone of Appling's 10 Frio sand pays.

The plan, in brief, would distribute all allowables in the field on a 100% acreage basis. Any operator feeling that he stood to benefit more under the present formula, however, could designate one completion in his well (either oil or gas) to receive the "confiscation allowable."

He could later transfer this allowable on adequate showing from one completion to another on the same lease.

Such a special allowable, Alcoa argues, would prevent compounding of the injury to large-acreage owners as now happens in a field such as Appling where there is more than one pay zone.

Need acute . . . Appling's 22 town-lot wells had about 7.5 billion cubic feet of gas in place originally—or about 1.8% of the field's total reserve, Alcoa contends.

These wells, however, had produced more than twice this amount as of January 1. Small-tract production, Alcoa said, totaled 16.5 billion cubic feet. And this is roughly 30% of total gas produced by all operators.

For emphasis, Alcoa submitted evidence on what it called a typical town-lot well in Appling—a well drilled on 0.115 acre in Carancahua Beach.

Royal W. Reiss, oil and gas operations manager for Alcoa, told the commission this tract originally contaoined a total of only 24,000,000 cu. ft. of gas from all underlying Frio reservoirs.

He calculated the value of these gas reserves, including liquids, at $5,000.

Under the present formula, Reiss said, it would take this well only 15 days to produce this reserve if it were triply completed in the Middle Kopnicky, 7,500-ft. sand, and lower 7,600-ft. sand.

Average cost of a single completion in the field to the deepest horizon at 8,400 ft., he said, is $110,000. Each added completion adds another $10,000 to $15,000.

Some don't agree . . . Essentially all major operators in Texas and many independents frown on Texas' practice of permitting the drilling of wells on tiny leases or of granting allowables which make it so profitable.

But the Alcoa proposal fails to excite many interviewed by the Journal as a solution to the problem.

One proration engineer said a compromise "would sacrifice a principle for the sake of expediency." Another company spokesman said he hopes the courts will solve the small-tract problem.

The Railroad Commission apparently is going to take a long, hard look at Alcoa's proposal before making a ruling. Oral arguments are scheduled June 6.

Miscible Plan Approved

THE TEXAS Railroad Commission last week approved operators' plans to unitize and launch an unusual miscible-recovery program in West Texas' University Block 9 Wolfcamp field.

The project will employ the high-pressure gas miscible technique. But operators will have to inject the equivalent of about 10,300,000 bbl. of gas, LPG, and water to boost pressure from the present 1,485 psi. to about 4,300 psi. before this process will function at top efficiency.

Atlantic Refining Co., unit operator, estimates the drive will hike Block 9 Wolfcamp recovery by about 35,830,000 bbl. (OGJ, May 9, p. 100).

PROCESSING BRIEFS . . .

Controlling interest in Petroleum Chemicals, Inc., has been acquired by Cities Service Co. The company was formed on a 50-50 basis by Cities Service and Continental Oil Co. in 1954. It acquired the government-owned butadiene plant in New Orleans in 1955. Since then it has expanded the unit, added an anhydrous-ammonia plant, and built a 200,000,000-lb. ethylene plant. The change in ownership gives Cities Service a 55% interest and Continental a 45% interest.

A license for the use of Cosden Petroleum Corp.'s technique for manufacturing polybutene has been issued to Naphtachimie of Paris, France. The French firm is building a butadiene extraction unit for polybutene production.

Ethyl has developed its fourth phosphorous additive, Ignition Control Compound 4, which, it says, provides more phosphorous per pound of compound than any similar preignition control additive. Ethyl claims the

Fireworks Likely When FPC Nominees Quizzed

• Current FPC investigation and controversy over Connole's ouster may touch off some sharp questioning when Sweeney and Donegan go before senators.

PAUL A. Sweeney and Thomas J. Donegan, selected by President Eisenhower to serve on the Federal Power Commission, are scheduled to face a Senate committee next week.

The hearing, by the Senate interstate and foreign commerce committee, is part of the standard routine of Senate action on presidential appointments to regulatory agencies.

This one may create some fireworks, however, because of the current controversy over the FPC and over the President's failure to reappoint Commissioner William R. Connole. (See related story, p. 96.)

Democratic members of the committee may seek to stall action on the appointments, thus leaving the selections up to a new president in January.

But observers also point out that the committee may find it awkward to create a delay unless it can come up with some reason for opposing the two new appointees.

Since neither Sweeney nor Donegan is a controversial figure, such a development seems unlikely.

Donegan is likely to be subjected to the sharpest questioning simply because he has been chosen to replace Connole. Sweeney is to fill out the term of the late John B. Hussey.

The nominees . . . If criticism of either develops it is likely to be focused on the fact that neither has had public utility regulatory experience. Donegan, a former FBI agent, is now a member of the Subversive Activities Control Board. Sweeney is first assistant in the Justice Department's office of legal counsel.

Paul A. Sweeney
. . . former oil-field roughneck.

Thomas J. Donegan
. . . he pays his gas bill.

Although he has been a government attorney for many years, Sweeney is not unfamiliar with the oil industry. His father was an oil-field worker, starting in Pennsylvania and migrating to Oklahoma.

Sweeney, reared in Bartlesville, Okla., worked as a roughneck in the oil fields during summers while he was attending college and tried to get an oil law practice started in Tulsa after he was graduated from law school. But that was in the early twenties and things were slack, so Sweeney took a job in Washington.

As a Justice Department attorney, he has handled many natural-gas cases which had been appealed to the higher courts.

By contrast, Donegan has had no experience with oil or gas cases and has been widely quoted as saying that his only knowledge of the oil and gas industry stems from paying a monthly gas bill.

However, in his present role he hears cases as a board member, much as FPC commissioners do, and because of his legal training he prides himself on his knowledge of the law and his ability to rule on facts and evidence. He also has had some accounting experience, which could be of help in gas rate cases.

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compound will increase spark plug life 3 to 3½ times, reduce surface ignition 70 to 80%, and greatly reduce the incidence of rumble. The new additive, trimethyl phosphate, presents no inductibility problems, has low antiknock destructiveness, and has no effect on the storage stability of leaded gasolines.

A 5,000 bbl. refinery will be built at St. John's, Newfoundland, by Golden Eagle Refining Co. of Canada, a newly organized subsidiary of Ultramar Co., a British holding company. It will be the first refinery in the province.

An HF alkylation unit with a capacity of 1,500 bbl. daily of butylene alkylate has been placed in operation at the Santa Fe Springs, Calif., refinery of Wilshire Oil Co. It was designed by Universal Oil Products Co.

A butadiene unit, utilizing the Houdry dehydrogenation process, is now on stream at the Japan Synthetic Rubber Co., in Yokkaichi, Japan. The unit has a capacity of 25,000 tons per year.

Also for Refiners . . .

IN THE NEWS: Interior wants to revise imports quotas (p. 92) . . . Rathbone tells refiners they need a new product—profits (p. 94) . . . Refiners will be facing rumble and knock for a long time (p. 94) . . . Humble opens big polypropylene plant at Baytown (p. 98) . . . Polyisoprene looks like a comer in petrochemicals (p. 99) . . . Octane outlook: Less spread between premium and regular (p. 100) . . . Ethyl improves line blending (p. 108).

PLUS THIS TECHNICAL FEATURE: Selected papers from the API midyear refining meeting (pp. 123-166).

Ethyl Improves Line Blending

. . . by increasing accuracy and adding flexibility. New system, says Ethyl, saves unneeded expensive components.

A NEW system for blending gasoline in a refinery's pipelines has been developed by Ethyl Corp.

The system, Ethyl says, uses a digital computer and punch cards to control blending to a high degree of accuracy. Ethyl will engineer, design, and supervise construction for commercial units.

The system, Ethyl says, has several advantages:

. . . **Signal strength** has no effect on the system. It is activated by electrical impulses only and is not subject to errors caused by variations in strength of the signals.

. . . **A built-in safeguard** protects against disproportionate blending. If the flow of one component is restricted, others are cut back proportionately, and blending continues at a lower rate.

. . . **Flexibility** is achieved by ability to locate control valves and meters as far as several thousand feet from the control center. It is not necessary, Ethyl says, to bring component lines near the blending-control center.

Ethyl says any number of gasoline stocks and additives can be blended simultaneously.

Accuracy in blending saves money by cutting down on expensive components which would be added to guarantee meeting specifications in a less closely controlled operation.

Cards punched with coded information on quantity and composition of the blend control the operation. A card for a given blend is inserted in the card reader, the master control turned on and the blending begins. When the predetermined quantity is reached, the master control stops all operations. This eliminates the human element entirely from the actual control of the blending.

Ethyl plans to install one of its multicomponent blending units at its Houston plant.

Bisti Operators Ask Higher Allowable

GREATER production for the miscible-phase unit in the center of Bisti field will be sought at a hearing May 18 in Santa Fe, N. M.

Sunray Mid-Continent Oil Co., operator for the seven companies in the Central Bisti unit, is asking for revision of field rules. It says the present allowable, established last March, restricts production too severely and "provides no incentive for pressure maintenance."

The unit's 60 producing wells are now making about 3,450 bbl. daily, less than half the northwestern New Mexico allowable of 120 bbl. daily for 80-acre wells. Sunray would like to obtain a unit allowable, rather than a per-well allowable, with permission to produce good wells at a rate which would make up for low-output wells.

The company points out that a 120-bbl. allowable for the unit's 60 producers and 21 injection wells would total 9,720 bbl. daily. It has indicated it would be satisfied with a flat unit allowable of 5,000 bbl. daily.

The miscible-phase project was initiated last year at a cost of $3,250,000. Before unitization, the area produced as much as 5,000 bbl. a day. Operators voluntarily cut production for a 6-month period last year from 3,500 to 1,250 bbl. daily while the LPG slug was being placed and pressure built up.

Also in the unit are Amerada petroleum Corp., El Paso Natural Gas Co., Pan American Petroleum Corp., Phillips Petroleum Co., Shell Oil Co., and Southern Union Gas Co.

PIPELINE BRIEFS . . .

Laying of the 1,800-mile gas pipeline from the Permian and Hugoton basins to the California boundary has been completed by Transwestern Pipeline Co. The line, ready for operation in July, will deliver natural gas to the Pacific coast from fields in Texas, Oklahoma, and New Mexico. The line is solidly welded and will join the Pacific Lighting Gas Supply Co.'s line near Needles.

A 72-mile gas pipeline, costing more than $6,000,000, will be built by Alberta Gas Trunk Line Co. from near Torrington to the vicinity of Rimbey, Alta. Completion is scheduled by September 30. Bannister Construction Co. of Edmonton is contractor for this 24-in. extension of Trunk Line's main line.

Some 37 miles of gas line will be installed this year by Pacific Gas & Electric Co. on its California system. Company crews will lay 11 miles of 20-in. from Pittsburg to Walnut Creek, 9 miles of 12-in. from Berenda Creek to Chowchilla, 8 miles of 16-in. and 2 miles of 10-in. at Fresno, and 7 miles of 16-in. from Ignacio to Petaluma.

A 25-mile gathering system of 2, 3, and 4-in. pipeline has been completed by Rock Island Oil & Refining Co. connecting Skelly Oil Co. leases in Cahoj and Wilhelm fields, Kans., and Reiher field, Neb. The connections will eliminate trucking charges of 40 cents a barrel.

Up to 17,000,000 cu. ft. daily will be taken by El Paso Natural Gas from Bisti field, in New Mexico. FPC has granted authority to install 3,470 hp. on the Bisti gathering system costing $1,454,000. El Paso proposes to take 25,000,000 cu. ft. daily from Bisti in another application.

A 30-mile 2 to 20-in. gas line is being laid by Milwaukee Gas Light Co. under contract to Mohawk Contractors, Inc., Butler, Wis.

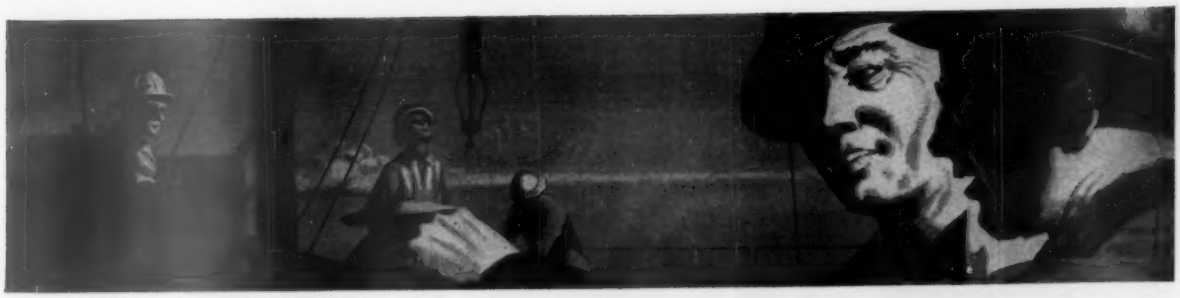
Expansion of Pembina Pipe Line's crude-gathering system is being done by Mannix Co., Ltd., Calgary. The contractor expects to install 70 miles of 3 to 10-in. in the Alberta field by December 15.

Also for Pipeliners . . .

IN THE NEWS: Congressional subcommittee hearing concerning Corcoran incident shows FPC swamped with work (p. 96) . . . Indiana Standard delivers directly from pipeline to tank trucks with "key-stop" technique (p. 102) . . . Utilities have mixed feelings over using compact cars (p. 104) . . . Two FPC nominees will face senators next week (p. 107).

A complete list of pipeline projects is carried in the last issue of each month. Current projects are carried in Pipeline Briefs.

PLUS THESE TECHNICAL REPORTS: Avoid shorts at cased pipeline crossings (p. 189) . . . Alaska gets its first crude line (p. 191).



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The Facts About Baker Retrievable Bridge Plugs

WHY RETRIEVABLE BRIDGE PLUGS?

Baker designed them to fill a need for bridge plugs that could be set or reset any number of times without coming out of the hole. Without retrievable plugs, drill-up time alone would be a formidable cost factor in certain operations *(see below)*.

HOW THEY WORK

1 A Baker Retrievable Bridge Plug is run in on the Baker Full Bore Cementer – or by itself on wire line or tubing. Large bypass valves let it run freely.

2 Operation is simple and positive. Once in the hole and released, it sets and packs off automatically – no rotation is required.

3 Packoff is dependable. Two packing cups and two opposed sets of rocker slips hold pressure from either direction. When pressure differential reverses, the packoff reverses automatically.

WHERE AND HOW THEY ARE USED

1 They do many jobs. They see the most action in fracturing, acidizing, and squeeze cementing operations where they are teamed with the Baker Full Bore Cementer.

2 These are the bridge plugs that made conventional straddle tools obsolete. A Baker Retrievable Bridge Plug and a Full Bore Cementer can straddle virtually unlimited distance.

3 Because these plugs are so easy to pick up and relocate, any number of zones can be tested and treated in one round trip.

4 They are also used alone wherever a temporary plug is required down-hole.

5 They are used to plug off just below surface to keep the well under control when working over or testing well head equipment.

6 They are kept available as emergency equipment for offshore wells.

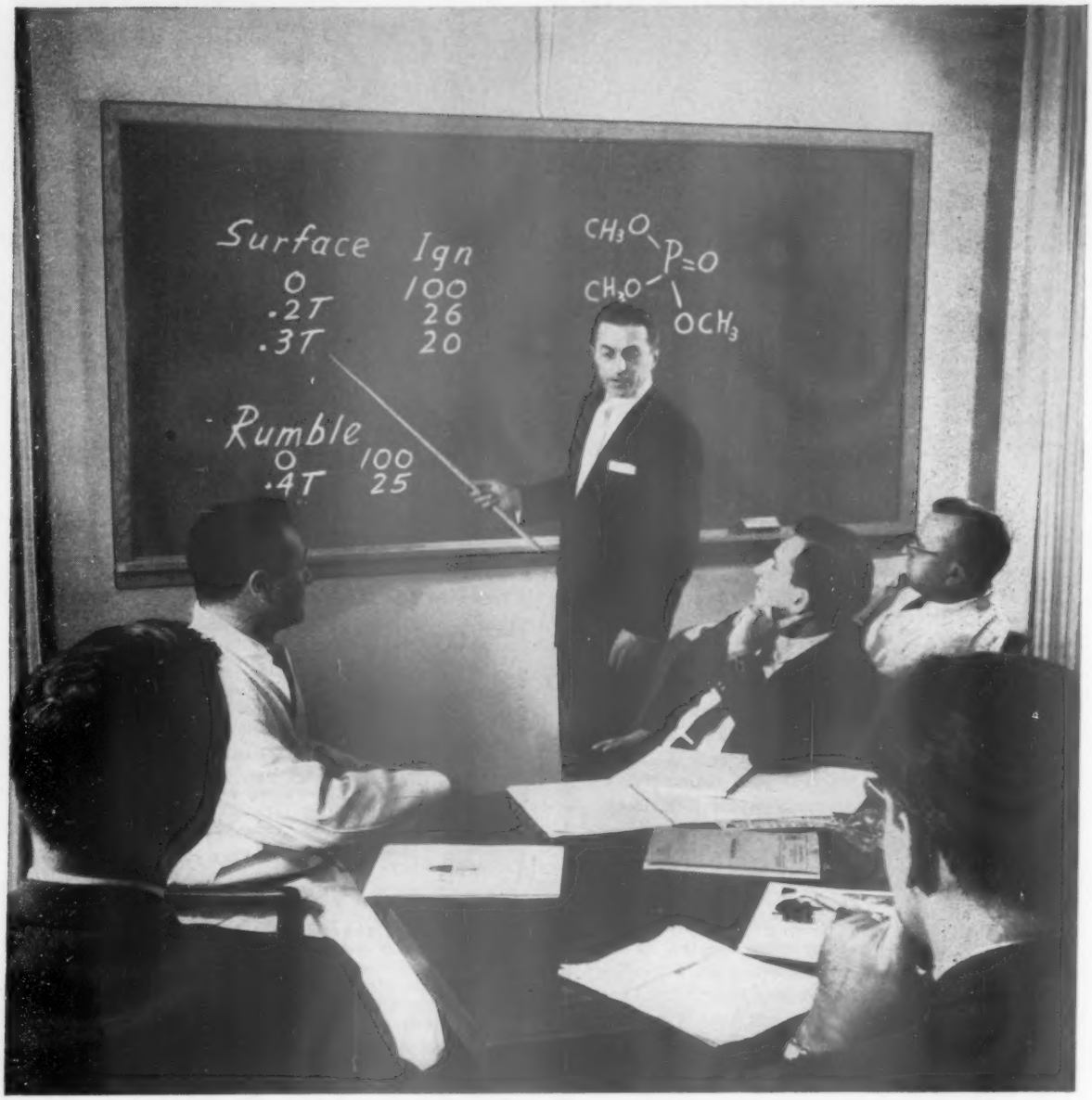
ARE BAKER PLUGS SUPERIOR?

For one thing, Baker Retrievable Bridge Plugs have two sets of opposed rocker type slips. In Baker's opinion, a retrievable bridge plug needs this extra holding power. Moreover, the plug is self-setting. Setting requires neither rotation nor pulling. Note this, too: the bypass valves have no ports or slots to plug up with mud, sand, or junk. They are full-opening 360° valves. These bridge plugs are simple in design, and are simple to operate. That is why they adapt with easy flexibility to the performance of many important operations.

BAKER

RETRIEVABLE BRIDGE PLUGS

BAKER OIL TOOLS, INC.
HOUSTON
LOS ANGELES
NEW YORK



THE NEWEST AND MOST ECONOMICAL PHOSPHORUS ADDITIVE!

"Ethyl" Ignition Control Compound 4 provides more phosphorus per pound at a lower cost

A NEW ECONOMICAL PROCESS for manufacturing ICC 4 (trimethyl phosphate) now provides refiners with the lowest cost phosphorus protection. Thoroughly tested in both laboratory and field, it proved its effectiveness as a gasoline additive and had no undesirable side effects.

A new plant for manufacturing ICC 4 has been completed at Baton Rouge, La., and commercial quantities are immediately available. This phosphorus compound is an exclusive Ethyl product and its use as a gasoline additive in the United States is covered by patents.

Effectiveness of "Ethyl" ICC 4

Ethyl Research tested the effectiveness of ICC 4, in gasolines containing 3.0 ml. of tetraethyllead per gallon, as a suppressant of surface ignition and rumble, and as an extender of spark plug life. In every case, ICC 4 proved to be equally effective with other phosphorus compounds on the market, and showed a marked improvement in cost effectiveness.

Surface ignition tests were made in single-cylinder engines.

Phosphorus	Relative surface ignition counts, %
None	100
0.2 theory ICC 4	26
0.3 theory ICC 4	20

Rumble frequency was tested in a V-8 engine with a 12 to 1 compression ratio.

Phosphorus	Rumble, % of observations	Mileage Accumulations
None	100	8,000
0.4 theory of ICC 4	25	9,500

Spark plug life was tested in V-8 engines operated on a dynamometer.

Phosphorus	Relative life to fouling, %	
	Engine A	Engine B
None	100 (27 hours)	100 (32 hours)
0.2 theory of ICC 4	330 (89 hours)	355 (114 hours)

No Deleterious Side Effects

Exhaustive tests in current fuels show that ICC 4 has no undesirable effects on gasolines or engines:

1. Low antiknock destruction.
2. No effect on intake system deposits.
3. Satisfactory exhaust valve durability.
4. No effect on pistons, rings, or bearings.
5. No effect on storage stability of leaded gasolines.
6. And ICC 4 is compatible with other gasoline additives.

Solubility a Minor Factor

Because ICC 4 is water soluble, some phosphorus is extracted from gasoline into water contained in storage and pipeline systems, of course. However, losses are small and economies are only slightly affected.

Extractability studies indicate that initial losses will be small in routine blending or storage operations. Moreover, the concentration in water bottoms will slowly reach equilibrium with the concentration in gasoline: thereafter losses will be negligible. Losses are greatest when ICC 4 is first introduced.

Economics of "Ethyl" ICC 4

Ethyl has studied typical refining situations to establish the savings that can be made using ICC 4 as a substitute for phosphorus compounds that are less water soluble. Evaluations carefully allowed for losses in blending, storage and service station tanks.

First year savings range from 10 to 15% of total phosphorus additive cost. Greater savings are made when water bottoms achieve equilibrium or are eliminated.

How Ethyl Research can help you

Like all "Ethyl" products, ICC 4 is backed by a full complement of technical and research services. If you wish, your Ethyl Representative will arrange for technical specialists to assist you in determining its most economic use in your refining situation. He also will be glad to supply you with detailed technical literature.

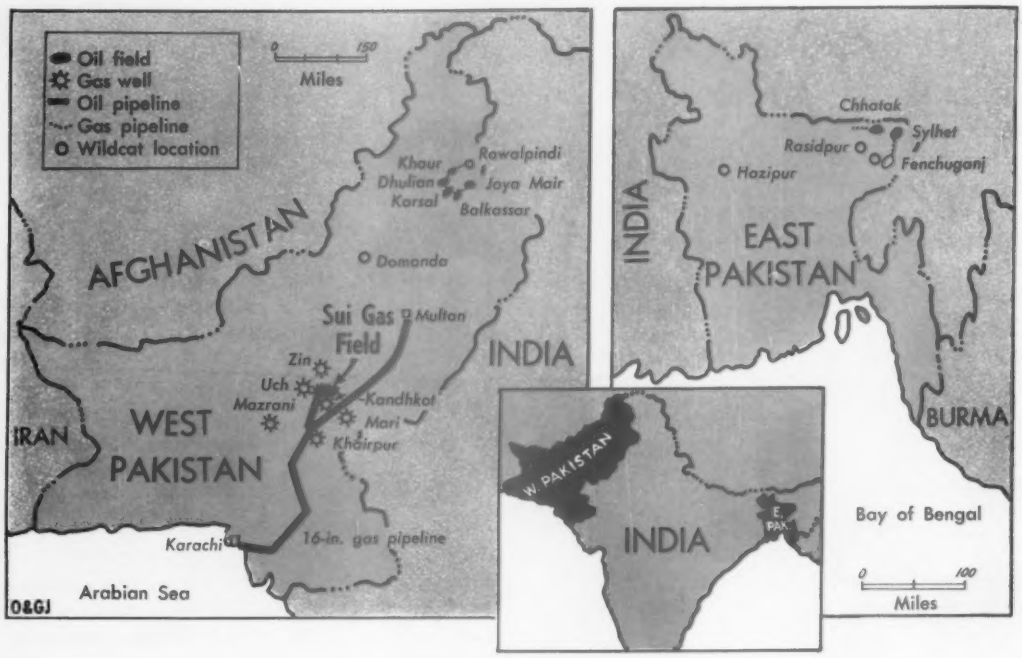
Samples are available now for test purposes from your Ethyl Representative, or by writing to Ethyl Corporation Research Laboratories, Technical Service Department, 1600 West Eight Mile Road, Ferndale 20, Michigan.

ETHYL ADDITIVES ETHYL CORPORATION

ETHYL CORPORATION
New York 17, N. Y.

Ethyl Corporation of Canada Limited, Toronto
Ethyl USA (Export) New York 17, N. Y.

RESEARCH LABORATORIES—Ferndale 20, Detroit, Mich. • Baton Rouge, La. • San Bernardino, Cal.



After a hard hundred years . . .

Pakistan Still Searches for Big Oil

• Huge structures and oil seeps stimulate exploration efforts in the bisected country. But the only strikes since World War II have been gas wells.

OPERATORS in Pakistan have one consoling thought to fall back on. It took nearly 50 years of drilling to bring in the first commercial discovery. Now, with the end of the second 50 years in sight, somebody may be due for what is still to come—the first big oil.

Staffs running the exploration play in the two-part country lying on either side of the Indian subcontinent may need this type of reflection now and then for moral support. If ever the term "cantankerous" fitted an oil country, the honor belongs to Pakistan.

The country is dotted with huge structures, has oil seeps, and existing commercial production. And it has a waiting market for domestic crude production. Even so, one company stopped drilling last year, and as of last week, others still were waiting for the first really major oil pay.

This wait has gone on for a long time. The promise that still lures drillers attracted attention well back in the era when the region was part of British India. The first wells were drilled by the Punjab Government after word of Colonel Drake's discovery in Pennsylvania filtered out to India, and oil seeps were noted in 1866 in the Attock area of what is now the northern part of West Pakistan.

This and several other exploration ventures in Punjab's Indus River Valley were failures. Commercial production was not found until 49 years later when a syndicate that evolved into Attock Oil Co. struck oil at Khaur.

Khaur field, opened in 1922, was the first of a cluster of small fields that are operated by Attock Oil. Others in the group found since then include Balkassar, Joya Mair, and Dhulian. Output is refined at a small plant at Rawalpindi nearby, and products are marketed locally.

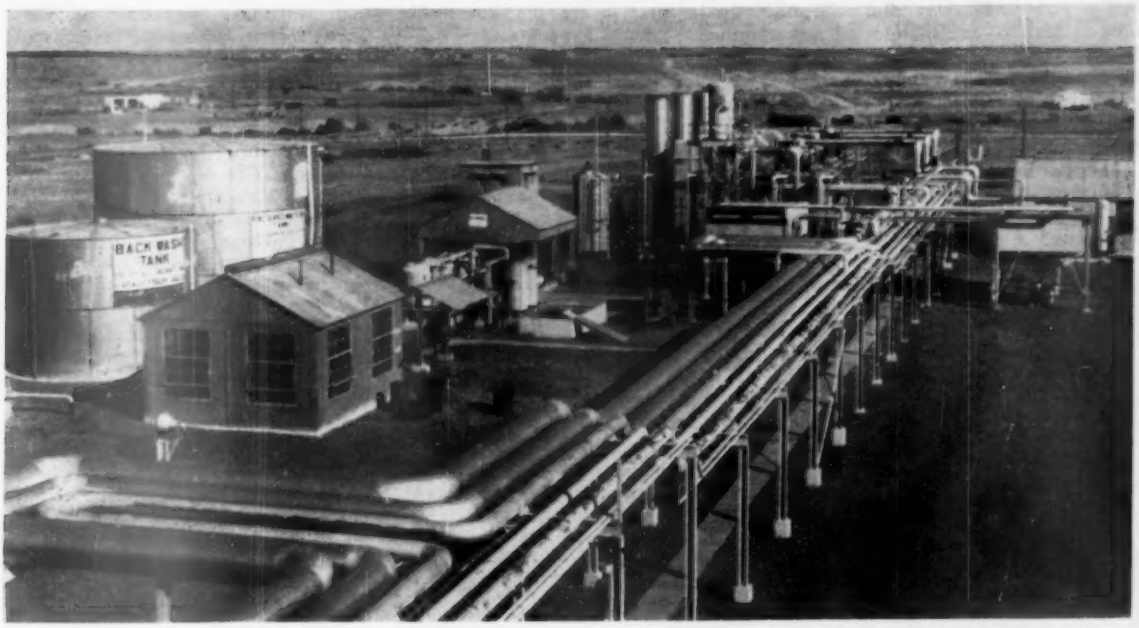
Another small field was added to the group last year when Pakistan Oilfields, Ltd., an Attock Oil subsidiary, drilled a successful test at Karsal jointly with Pakistan Petroleum, Ltd., a Burmah Oil Co. subsidiary. The two subsidiaries were set up under a law stipulating that new concessions can be granted only to companies incorporated in Pakistan. Private and government capital also took 30% interest in each venture. In addition to Karsal, Pakistan Petroleum also has a joint interest in Balkassar field.

While the total output of these fields is only 8,500 bbl. daily, this production, in the face of other factors, has coaxed companies into spending millions in search for bigger oil pools.

740-ft. gas pay . . . Burmah Oil Co. has shouldered most of this load, both before and after World War II. In the period of World War I and the 1920's, the company drilled seven dry holes in what is now West Pakistan, and three dry holes in East Bengal, now East Pakistan.

Other companies which drilled unsuccessfully in the same period were Whitehall Petroleum Corp., which drilled a well at Jhatla, and Indo-Burma Petroleum Co., which drilled several tests west of the Indus River.

Major success did not come, however, until after World War II, when Burmah Oil's Pakistan Petroleum drilled into a major gas structure at Sui, in Baluchistan, west of Sind. Interest in the area dated back to the 1880's when the Indian Government



GAS PURIFICATION plant at Sui gas field treats the output of six wells before transmission to distant cities. The Sui reservoir covers an area of about 75 sq. miles in the Baluchi Desert of West Pakistan.

drilled a number of shallow holes, and recovered a total of about 25,000 bbl. of crude before giving up the project. Burmah Oil itself drilled a 4,512-ft. dry hole at Khairpur, 70 miles south of Sui, in 1925.

The well at Sui, in Baluchi Desert, was located on a pronounced dome pinpointed by field mapping and aerial surveys. After 9 months of drilling, the wildcat drilled into a gas pay that has been the major spur to exploration in the area ever since.

Sui reservoir covers an area of about 75 sq. miles, with a maximum column of about 740 ft. Reservoir pressure is approximately 1,955 psi. and gas after purification has a calorific value of at least 975 B.t.u. There was no measurable decrease in pressure after 25 billion cubic feet was drawn from the dome. Reserves of recoverable purified gas are from 4.5 to 5.5 trillion cubic feet, taking into consideration reservoir control, porosity, compressibility, and other factors.

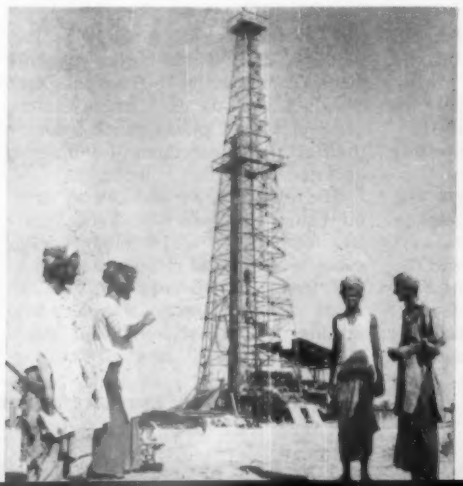
The raw gas has a relatively high methane content of 90.10%. The remainder consists of 0.85% ethane, 0.10% propane, 0.15% butane, 0.05% pentane, 0.16% hexane, 4.5% carbon dioxide, 3.5% nitrogen, 0.02% helium, and about 0.5% sulfureted hydrogen. Condensate is produced at the rate of about 18 gal. per 1,000 M.c.f. of gas.

The immediate prospects for marketing the gas were limited. But Burmah Oil, with an eye to the future, built a 348-mile 16-in. pipeline to Karachi, and later ran a line of similar size northward to Multan. There are now six gas wells on the structure. Production at the end of last year had risen to 50 million cubic feet daily. This level will probably rise to 100 million cubic feet daily by the end of next year.

The gas moves to market under its own pressure. Purification facilities are being added, which may enable the company to produce enough sulfur to make this a commercial sideline.

More gas . . . The gas find at Sui whetted hopes for oil structures of similar dimensions. So far, however, no new oil has been found with the exception of Karsal, where the fourth

NATIVES WERE hopeful when this well was drilling near Jacobabad, but it was unsuccessful.



WELLHEAD valve in the Sui gas field gets a turn from a Pakistani worker. The maximum pay column in this reservoir is 740 ft.

well is now under way. But wildcat after wildcat has drilled into gas pay. Pakistan's gas reserves are now placed at about 11 trillion cubic feet, with an over-all average of 70% methane, 16% carbon dioxide, and 13% nitrogen.

Pakistan Petroleum has found most of the gas. Its first well after Sui, at Zin, the high on a 70-mile-long structure, tested 3 million cubic feet daily of gas, with a reservoir pressure of 279 psi. There is an estimated 100 billion cubic feet of low-grade gas, with 52% inert matter.

A bigger field was found at the next test at Uch. Reserves are estimated at 2.5 trillion cubic feet. But even after removal of 46% carbon dioxide, the calorific value is only about 550 B.t.u. The gas yields about 30 gal. of condensate per million cubic feet.

Another 250 billion cubic feet was found at Khairpur. This has no commercial potential, however, with 90% inert material. Another 200 billion cubic feet was found at Kandhkot. Pakistan Petroleum is still trying for oil in West Pakistan, however, this time with a wildcat at Dowanda.

A Standard-Vacuum subsidiary, Pak-Stanvac Petroleum, has the second-best gas field, at Mari. Stanvac found gas in the 11,000-ft. range in two of three Mari wells. It estimates its reserves of combustible gas at 2.8 trillion cubic feet. The raw gas has 74% methane, with a calorific value of 790 B.t.u. Reservoir pressure is 1,035 psi. Because Sui gas has outlets to major markets, Mari will probably be shut in for the foreseeable future.

Hunt International Oil Co. uncovered 30 billion cubic feet of gas at Mazrani last year in a joint test with Pakistan Petroleum. But again, there is no market and the field is not being developed. Hunt, after 11 wells totaling 90,000 ft., has given up and shipped its rig to Libya.

Three other companies are taking a look at West Pakistan. Royal Dutch-Shell has drilled two dry holes. Tidewater Oil Co. has not started drilling on its own, but had half interest in one of two dry holes drilled at Karachi by Pakistan Petroleum. Pakistan-Sun Oil Co. has concessions, but has not started drilling.

The government holds 25% interest in the Stanvac, Shell, Tidewater, and Sun Oil ventures. There is a standard 50-50 profit split.

East Pakistan . . . The West Pakistan exploration picture is duplicated in the east wing of the country. Pakistan Petroleum has found gas fields at Sylhet and Chhatak, both of which lie in the northeastern part of East Pakistan, near the Indian border.

Here again, Burmah Oil subsidiaries are making use of the gas where they can. A 30-mile pipeline from Sylhet to Fenchuganj will be completed later this year. Reserves of 280 billion cubic feet will supply a new fertilizer plant being built by a Japanese firm. The Fenchuganj plant, together with a fertilizer plant under construction at Multan, West Pakistan, will make the country self-sufficient for fertilizers. One of Pakistan Petroleum's current wildcats is at Fenchuganj itself.

A shorter, 12-mile pipeline is under construction from Chhatak to a cement factory. This will open in a few weeks. Chhatak reserves are estimated at 20 billion cubic feet.

Stanvac has drilled two dry holes in East Pakistan. It is now drilling at Hazipur. Shell has a wildcat in progress at Rasidpur.

Tighten law . . . Most exploration is being carried out under laws promulgated in 1949, when Pakistan was 2 years old. These rules called for a private or government Pakistani participation of at least 30%.

The law was tightened considerably last year. The maximum area of any one lease was reduced from 100 to 50 sq. miles. Financial expenditure on exploration licenses was increased fivefold. Renewals are now limited to 1 year, instead of 3, and are restricted to one-half the original area. Rental on acreage has been placed on an ascending scale. The fee starts at 10 rupees, about $2.11, per square mile the first year. It doubles each year until rental reaches 80 rupees, or about $16.80, in the fourth year.

Most local demand is supplied by product imports. This picture will change in 1962 when a jointly owned 30,000-bbl. refinery opens at Karachi. The partners will be Burmah Oil, Shell, Stanvac, and Caltex, along with private Pakistani capital.

Gulf Hits Again in Western Libya

GULF Oil Corp. has a second oil well on its big Block 66 in western Libya.

The company swabbed 50 bbl. per hour of 39.2°-gravity crude in F1-66 wildcat. Pay was topped at 5,155 ft. The well is approximately 15 miles northwest of Emgayet 1, a 876-bbl.-daily discovery at about 4,100 ft.

The two wells are located in the central part of Gulf's 7,194,000-acre concession. Four other wells in the vicinity had interesting shows, but were finally abandoned.

Gulf's production lies in the same general part of western Libya where discoveries of possible commercial value have been made by Oasis and Shell. Emgayet 1 is approximately 100 miles east-southeast of Oasis' 450 to 500-bbl. discovery A1-26, located on adjoining Block 26. The Gulf finds also are about 150 miles south-southeast of Shell's 700-bbl. find at Bir Tlacson, on Block 70.

The company has one other rig active in Libya. This is drilling ahead from 3,180 ft. in A3 in Block 68, lying to the south in Fezzan.

ENI Will Construct Offshore Platform

THE ITALIAN Government will build its own offshore drilling platform with technical help and key parts furnished by R. G. LeTourneau, Inc., Longview, Tex.

LeTourneau built the only other mobile platform owned by Italy's government-owned company, Ente Nazionale Idrocarburi (ENI).

The new three-legged unit will be built by Nuovo Pignone, an ENI affiliate, at its plant at Massa, on the north coast of Tuscany, and at the nearby port of Marina di Carrara. SAIPEM, also an ENI affiliate, will operate the platform.

ENI has not revealed where the platform will be used. The company holds offshore concessions in the Persian Gulf, the Mediterranean, and the Adriatic. The first LeToureau-built platform, a tender type, has been operating off Sicily for nearly a year.

The new self-contained platform will be about twice as large as the first one for ENI and the largest with the LeTourneau label. The company has dubbed it the first of its "International Class" platforms and hopes to direct the construction of additional ones for the Italian company.

The platform, in addition to drilling equipment, will have living quarters for 50 men and enough storage space to operate in remote areas without frequent deliveries of supplies. Also it will contain an electronic sensing device that sounds an alarm if it settles out of level.

Companies Get Another Shot at Egypt

• Thirteen concessions covering 74 million acres in the Western Desert are being offered. Oil companies have until August 15 to submit bids.

EGYPT is putting up a vast 116,000-sq.-mile area in its Western Desert for concession bids.

The ministry of industry has set an August 15 deadline to accept oil-company offers for acreage in the region where oil prospects have been brightened the last 2 years by discoveries in Libya.

The desert is divided into 13 concession areas, which are made up of a number of exploration permits. Concession terms provide that 25% of the permits in each concession must be relinquished after 3 years, 50% of the permits after 6 years, and only 15 exploration permits may be retained in one concession after 10 years.

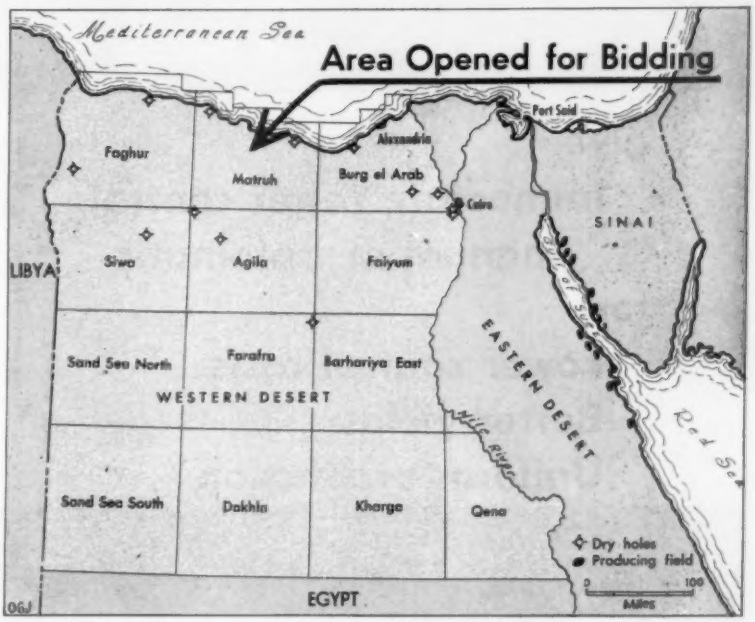
Royalty will vary, but the terms call for no less than 15% in cash for 10 years after the exploration permit has been converted to exploitation, and then 25% after that period.

It also calls for formation of an Arab company for the exploitation of any oil production, with the right of the government to participate in the company.

Cairo newspapers last month reported that Dr. Aziz Sidqi, UAR minister for industry, has already received 11 bids for Western Desert acreage from a number of companies, including Sahara Petroleum Co., which once held the major part of the desert under concession.

According to the Cairo report the companies bidding or expressing an interest include Pan American International; Atlas Corp., through Panoil Co. of Dallas; Mobil Oil International; Ente Nazionale Idrocarburi, Italy's government-owned oil agency; Anglo-Egyptian Oil Fields, a joint Shell-British Petroleum company that has long operated in Egypt; Atlantic Refining Co.; and Sahara Petroleum.

The area now being offered to prospective oil drillers is larger than the 90,000 sq. miles which was explored during the 1950's by Sahara Petroleum, a four-company combine of Americans. It includes all the original Sahara Petroleum concession, plus the region to the south where Pan American last year conducted a 2-month surface reconnaissance.



Sahara Petroleum's work . . . The four-company group of American firms drilled nine dry holes in the Western Desert, all but one below 10,000 ft., and spent more than $35 million in its unsuccessful 4½-year search. The operation was carried out by Sahara Petroleum, a subsidiary of Continental Oil, operating for its parent and three partners, Ohio Oil, Cities Service, and Richfield Oil.

The group's original concession covered all the territory west of the Nile and north of the 28th parallel. During 1957, the group gave up 25% of the original grant at the end of its first 3 years of operation. All the acreage turned back at that time was in the southern portion of the huge tract. Late in 1958, the group threw in the towel and turned back the remaining 57,600,000 acres after its ninth wildcat was bottomed dry at 12,390 ft.

Sahara's first tests were drilled in the northeastern sector of the vast desert and to the northwest of the Cairo vicinity where three other dry holes were drilled by others in the 1940's.

Sahara's first test, Borg el Arab, southwest of Alexandria and near the Mediterranean coast, was dry at 13,300 ft. Later in 1956, the company walked away from Wadi el Natrum at 13,348 ft., about 50 miles northwest of Cairo.

The following year, Sahara spread the Western Desert with four deep and widely spaced wildcats. The first, Gibb Afia, was abandoned at 10,066 ft. to the west of the big Qattara depression. It was followed closely by the Betty 1, drilled to 14,463 ft. in the east central part of the depression itself. The company tested another coastal area with the 14,998-ft. Mersa Matruh, near the town of Matruh on the northern coast. The fourth test was Baharia Oasis, in the extreme southern portion of the concession. This test only went to 6,042 ft. and was the shallowest drilled by Sahara.

The following year the company again tested the Qattara depression with Ghazalat 1, which went to 10,082 ft. The last remaining drilling was done that same year with Faghur, drilled to 10,925 ft. just to the east of the Libyan border, and the 12,390-ft. Mamura wildcat, along the seacoast about 75 miles east of Libya.

The only previous drilling done in this vast area of Egypt were four 6,000-ft. tests drilled in the 1940's by three different companies. Standard Oil of Egypt drilled two dry holes just west and slightly to the south of Cairo, one to 5,615 ft. and the other to 6,289 ft.

Southern Mediterranean Oilfields drilled a 6,253-ft. dry hole about 25 miles northwest of the Standard dusters. Anglo-Egyptian Oilfields drilled one dry hole about 100 miles west of Alexandria. It went to 6,115 ft.

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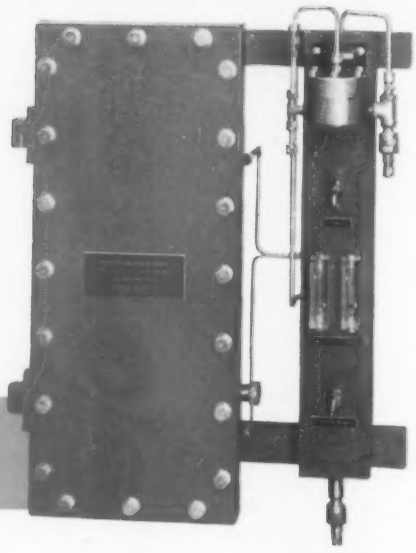
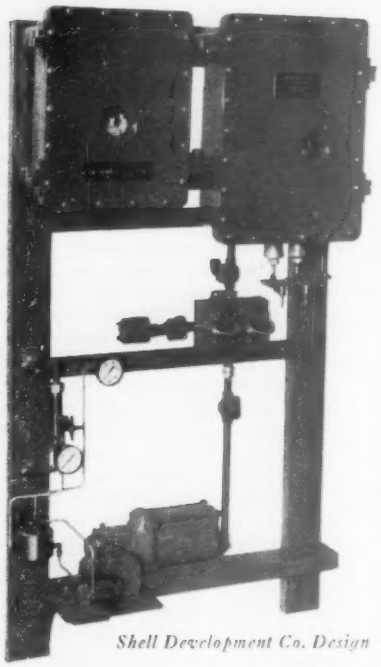


Shell Development Co. Design



Shell Development Co. Design

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With the refinery-proved Hallikainen-Shell Boiling Point Analyzers, you are certain of lower control costs, better yields and uniform products that always please customers by meeting specifications.

In that way, these new instruments pay out in 30 to 60 days. After that, the savings show up every month in lower costs for you.

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These Hallikainen Instruments—proved accurate, reliable and safe—operate with a **constant sample flow.** Aside from changing the recording chart daily, little attention or maintenance is needed.

Write for all the technical facts on the Hallikainen-Shell Boiling Point Analyzers and then decide for yourself how these instruments can save money for your refinery.

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1341 Seventh Street **Berkeley 10, Calif.**

Phone: LAndscape 4-1757

Production Starts in a Third Kuwait Field

• Raudhatain is not in the same class as Burgan, Kuwait's biggest field, but it will start out producing 100,000 bbl. daily and be increased to 200,000.

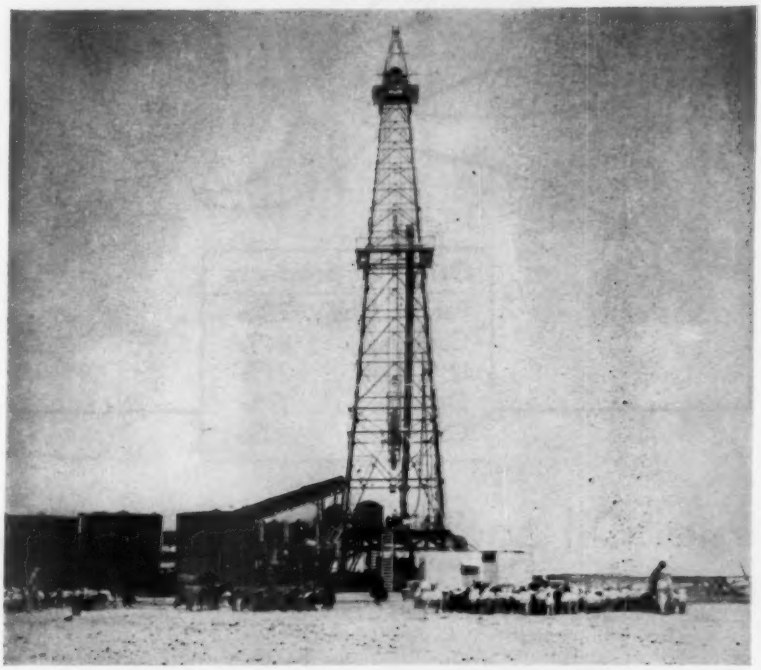
RAUDHATAIN oil field in northern Kuwait has gone on commercial production with an initial output of 100,000 bbl. daily.

The 5-year-old field is moving crude to Mina-al-Ahmadi tanker terminal on the Persian Gulf via a 65-mile 30-in. buried pipeline. Output will be stepped up later to 200,000 bbl. daily.

Kuwait Oil Co., jointly owned by British Petroleum and Gulf Oil, has drilled 26 development wells since the discovery was made late in 1955 in the 7,800-10,000 ft. range. In addition, a well at Sabriya and another at Bahrah are tied into the gathering system.

Field facilities include five pairs of gas/oil separators, working in two stages. The final stage takes place in two 50,000 bbl. flow tanks. The gathering center is designed for operation with a minimum of personnel and is combined with the power and pipeline pumping station. Three 900 hp. gas turbines drive three centrifugal pumps on the pipeline, while three 250 hp. diesel engines drive three 150 kw. generators for power needs.

Raudhatain is considered a good field, but not in the same class as Burgan in the south. Burgan is the source of most of the 1,500,000 bbl. daily produced in the shaikhdom, with Magwa-Ahmadi providing the balance until Raudhatain oil was added. Burgan and Magwa-Ahmadi maintained Kuwait as the world's fourth ranking oil country with only about 300 producing wells.



ONE OF THE RIGS used to drill the Raudhatain field in northern Kuwait. The 26 wells in the field are from 7,800 to 10,000 ft. deep.

Raudhatain 1 was bottomed at 10,301 ft. in October 1955 after testing commercial oil in several sands, ranging from Upper Burgan to Lower Cretaceous Zubair. The well was completed in a thick Burgan pay.

Three field wells were completed in Zubair, while the rest have been completed in Burgan pay. These test from 14,000 to 20,000 bbl. daily, and probably average 300 ft. of net pay (OGJ, Sept. 7, p. 116).

The Raudhatain pipeline terminates at Kuwait Oil's new North Tank Farm at Mina-al-Ahmadi. The pier can handle five medium tankers or two 100,000-ton ships plus two smaller vessels at the same time.

Drop in U. S. Workers Cuts Venezuelan Income

THERE ARE one-third fewer U. S. citizens working in Venezuela than a year ago, and this is costing the country from $21 to $30 million a year.

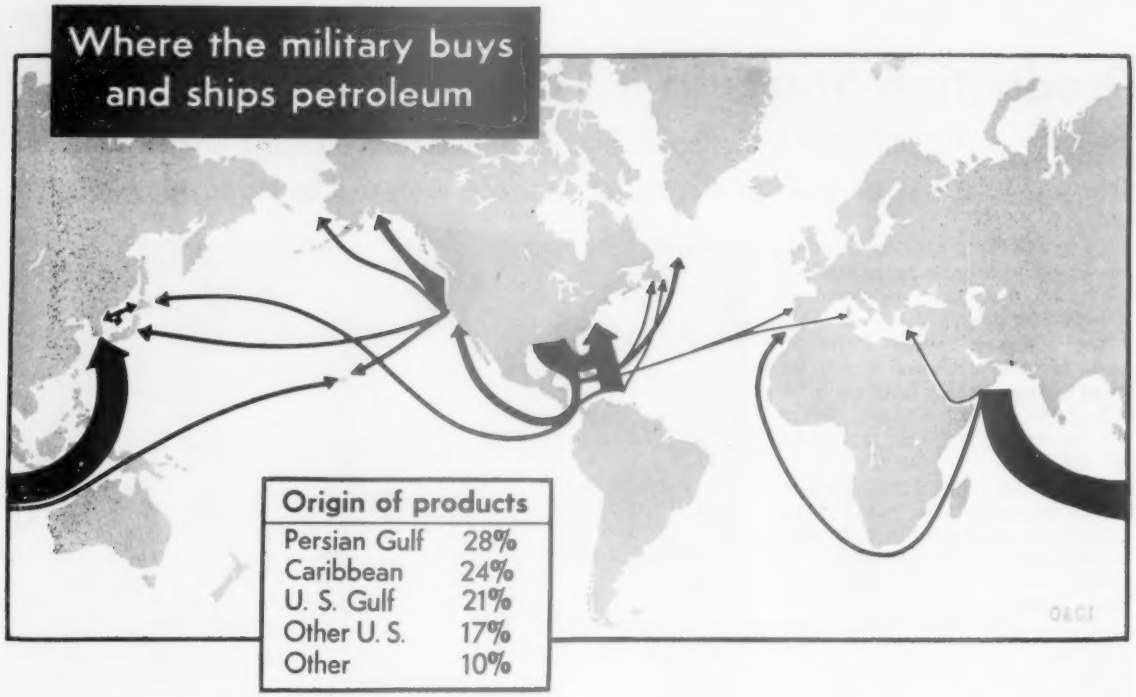
The sharp drop is one of the clearest indicators so far of the depressed state of the Venezuelan oil industry. A survey conducted by U. S. Consulates in the country showed that there were only 5,374 U. S. employes on March 31, compared with 7,891 a year ago. This is a difference of 2,517 employes, a decline of 31.9%.

The average American in Venezuela spends from $700 to $1,000 per month, consequently, the total loss to the Venezuelan economy is estimated at $21 to $30 million.

The consulate figures indicate only the minimum change. U. S. citizens are not required by consulates either to check in or check out of the country, and not all companies queried answered the census. The actual totals are believed to be considerably more.

Of the employes who left jobs, more than 650 were from oil companies. Personnel from service, supply, and contracting firms account for another 1,200 to 1,300 severances. There were 11 geophysical companies with offices in Caracas a year ago. Today there are none. The situation is similar for drilling contractors and supply stores, particularly in the Barinas and Anaco areas.

The ranks of geologists, geophysicists, and paleontologists were thinned by 101 persons last year, leaving a total of 333 on payrolls. The number of Venezuelan exploration technicians remained virtually the same, increasing from 48 to 49.



Fuel Oil and Jet Fuel Top Military Purchases

OIL'S biggest customer, the U. S. military, purchased more than half of its petroleum supplies from foreign sources in the last fiscal year.

Two areas, the Persian Gulf and the Caribbean, supplied 52% of the Military Sea Transportation Service total lift of 16,669,660 long tons in fiscal 1959. Almost two-thirds of the total transported was fuel oil and jet fuel, Vice Admiral Roy A. Gano, commander of MSTS, told the annual API tanker conference last week in Atlantic City.

The percentage breakdown on products is: Fuel oil, 34%; jet fuel, 30%; diesel fuel, 13%; avgas, 15%; mogas, 7%; and other 1%.

FOREIGN BRIEFS . . .

The second stage of a new petrochemical plant at Dormagen, West Germany, is going on stream. The new units of the Edrolchemie G.m.b.H. plant near Cologne include cracking and gas separation facilities designed to triple the company's ethylene output. British Petroleum and Farbenfabriken Bayer each have 50% interest.

A 50,000-bbl. refinery at El Palito, Venezuela, has been placed in operation by an affiliate of Mobil International Oil Co. The $30,000,000 facility processes crude from Barinas Province, in southwestern Venezuela, which is moved to the refinery by a 210-mile pipeline.

A NEW, deeper pay has been found in Israel's Heletz oil field by Lapidot Oil Prospectors. Ltd. The latest well in the 2,600-bbl. daily field, Heletz 25, has an indicated production of 150 bbl. daily from limestone encountered about 160 ft. below existing oil sands. The well also is good for 200 bbl. daily from the upper zone. The test, bottomed at 5,160 ft., was the first in Israel to obtain production from Cretaceous limestone.

The "Second Baku" producing area is moving westward. Russia says output from Baranovka and Slavkinsk fields in Ulyanovsk Province, west of the Volga River, will triple in the next few years. The province so far has not been an important factor in Soviet production.

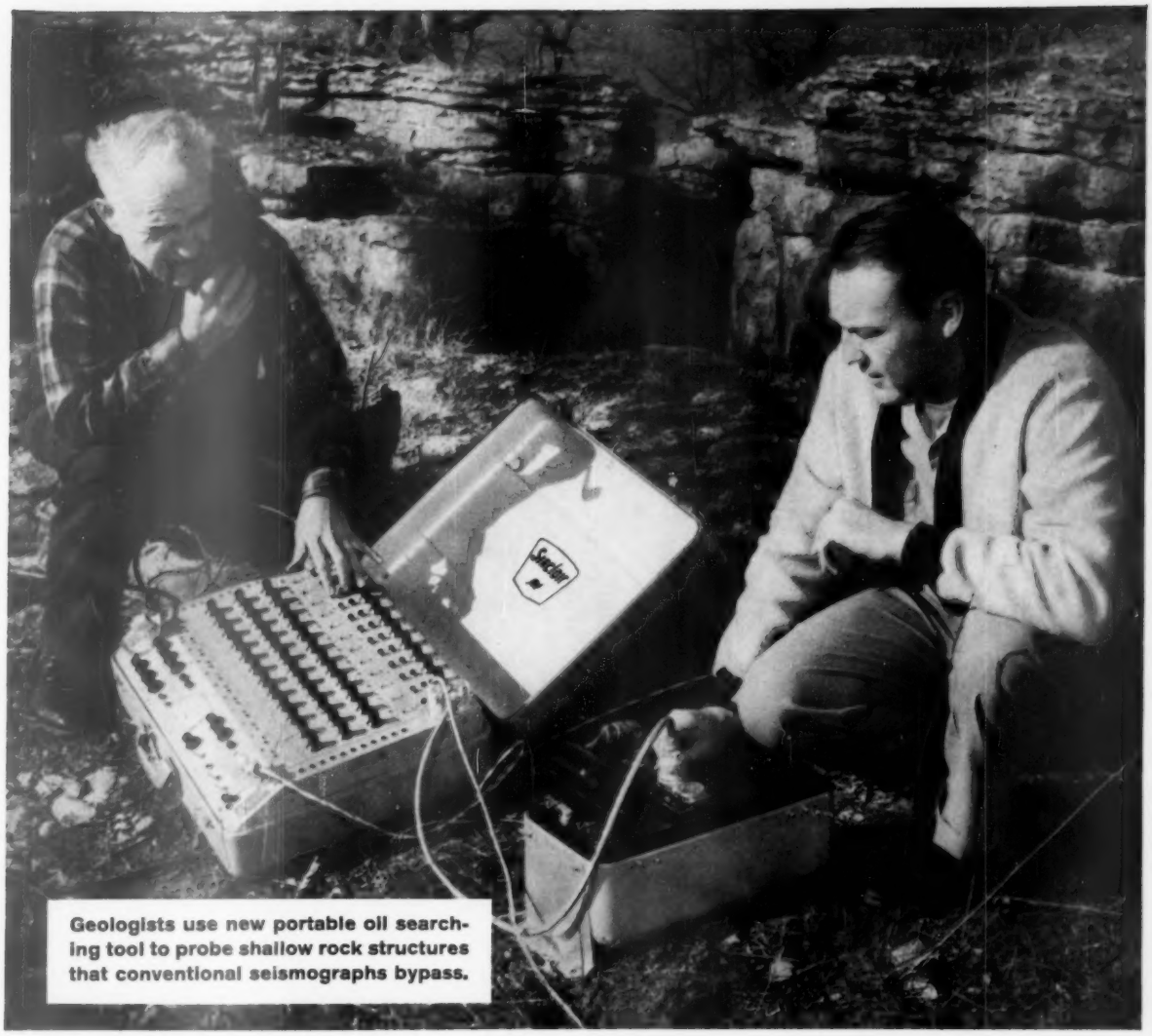
A seismic survey on 27,520,000 acres in western Queensland, Australia, is to be made by Phillips Petroleum and Sunray Mid-Continent. The companies have an option to drill to earn a full interest in a pre-selected one-half of the acreage from Papuan Apinaipa Petroleum Co., Associated Australian Oil Fields, and Associated Freney Oil Fields.

Russia is building drilling equipment capable of drilling wells in the 8,000-10,000 meter range, or 26,248-32,810 ft. It says the day is not far off when such depths will be reached. Deepest well in Russia to date is a 15,929-ft. hole in Zyr field, near Baku. Plans have been made for a 22,965-ft. hole in the same area.

A Yugoslavian oil discovery near the Austrian border reportedly may become the country's biggest oil field. The find is in Podravina.

A plant to produce polyolefins will be built by Foster Grant Co., Leominster, Mass. Initially the plant will produce polyethylene. The location and capacity have not been announced. Scientific Design Co., New York, has been awarded a contract to build the plant.

First drilling in the North Sea will be done later this year off the Netherlands. N. V. Nederlandse Aardolie, Mij. (NAM), owned by Royal Dutch-Shell and Jersey Standard, has picked three locations. NAM has placed an order with a British shipyard for a $1.4-million DeLong barge.



Geologists use new portable oil searching tool to probe shallow rock structures that conventional seismographs bypass.

Meeting the Future Need for Oil

The biggest job America's oilmen face is finding economically all the petroleum energy this country will need in the "soaring sixties." Most economists expect *petroleum demand to rise 50 per cent by 1970.*

Sinclair is tackling the heart of the problem by expanding its research into more efficient means of finding and recovering oil and gas. It is seeking scientific break-throughs that will mean more barrels of oil found and recovered per dollar spent.

One experiment being tested is the unique, portable seismograph above. Developed by Sinclair Research Laboratories, Inc., this device quickly probes subsurface areas bypassed by conventional instruments.

Sinclair believes that from research will come better ways of obtaining the low-cost petroleum energy *on which this nation thrives—and depends.*

Send for informative free booklet "Energy for the Soaring Sixties"—yours for the asking.

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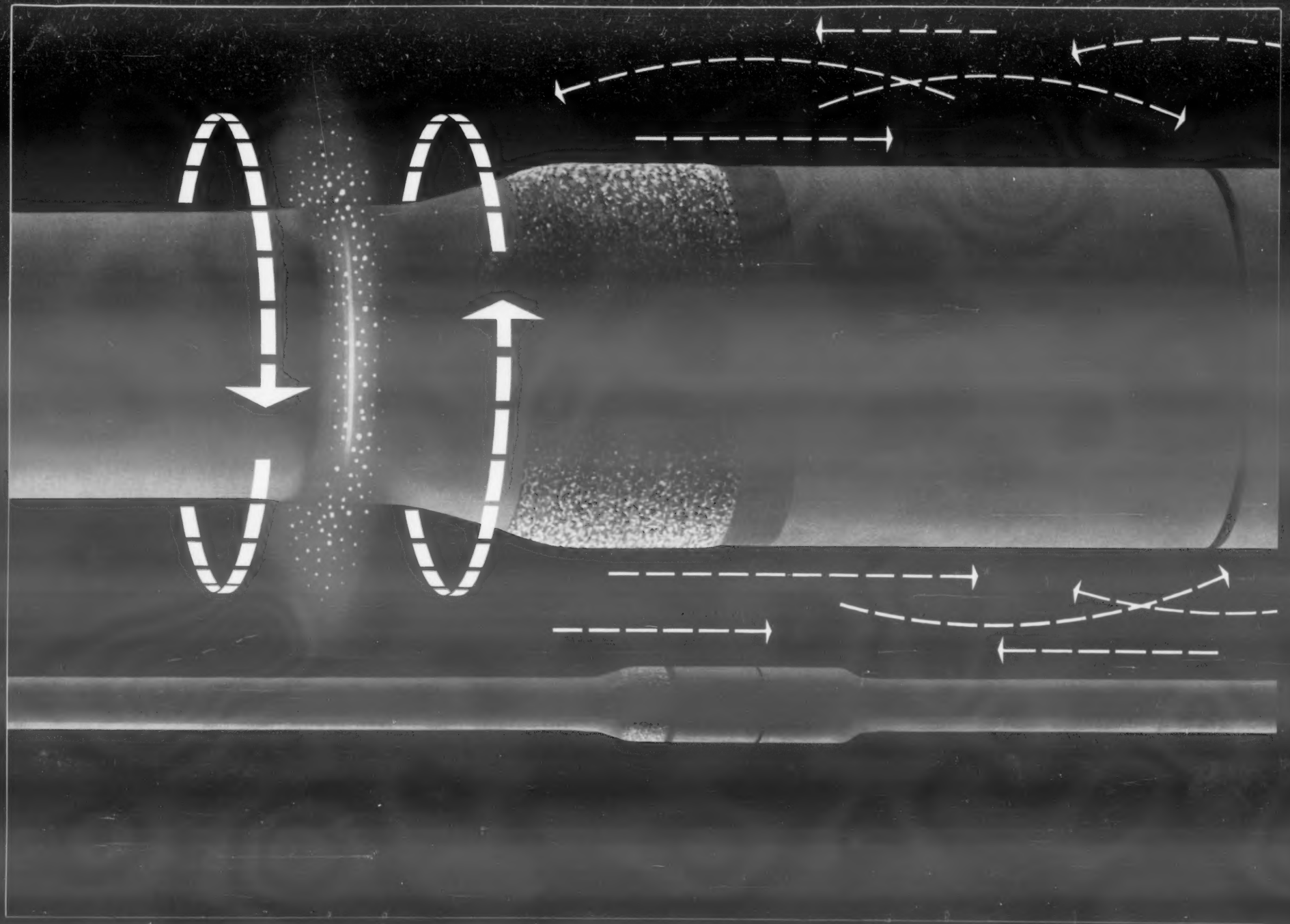

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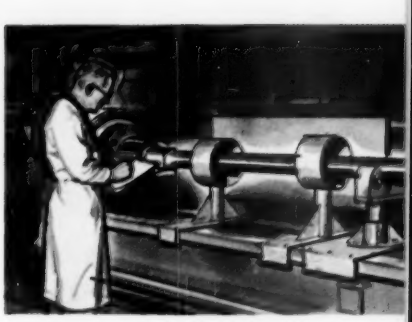

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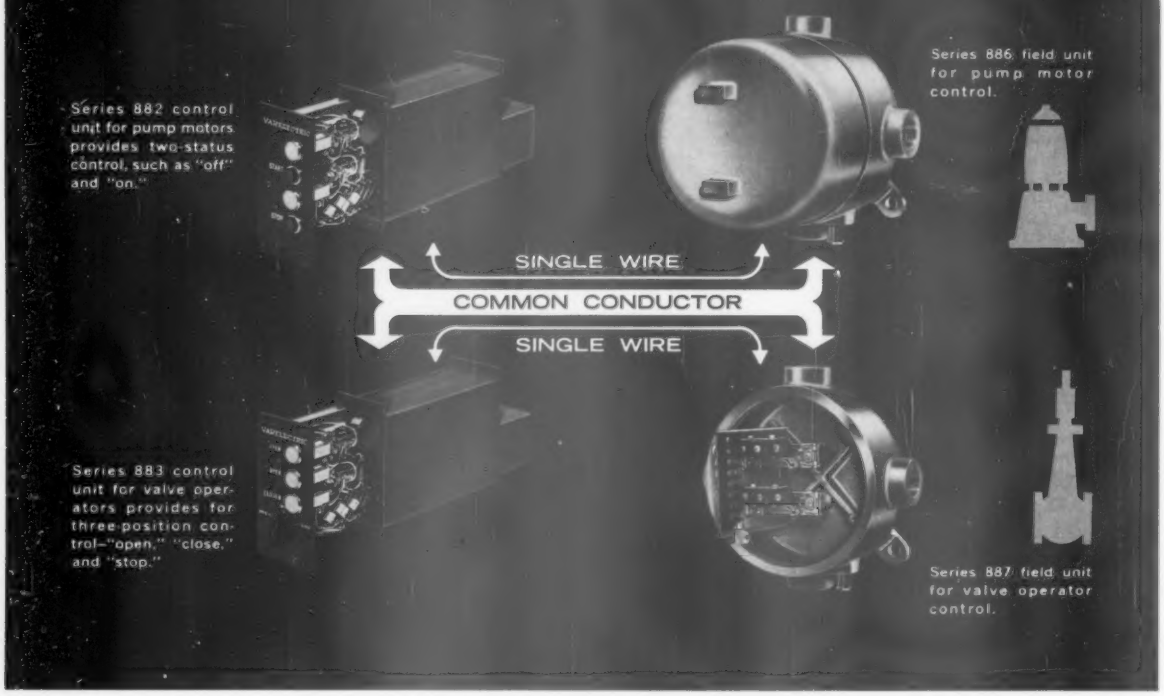
Series 882 control unit for pump motors provides two-status control, such as "off" and "on."
Series 886 field unit for pump motor control.
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Series 883 control unit for valve operators provides for three-position control—"open," "close," and "stop."
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Midyear REFINING Report

A SPECIAL SECTION

MAIN THEMES of API Division of Refining meeting in Detroit last week were better maintenance, better operation, and cutting corrosion.

Here are seven articles dealing with these three subjects. One, starting on this page, outlines the value of statistics in developing the refinery-inspection program. A second, also having to do with inspection, deals with the use of radiographic techniques. And a third gives tips which will help insure safe startups and shutdowns for refinery units.

Two articles are devoted to operation of distillation towers. One of these discusses the fast dynamic response of these towers and how this must be accounted for in operation. The other has to do with starting up and shutting down distillation units.

Two discussions, both based on surveys, deal with corrosion. One reports on the performance of corrosion inhibitors, while the other outlines the widespread usage of corrosion probes.

These highly significant articles strike right at the heart of a number of current refining problems. Turn to them and read them; they follow on pages 123-171.

Put statistics to work . . . in your refinery-inspection program. They help to estimate corrosion rates and equipment life. Here's how Sohio applies the technique.

BY W. P. SHONTZ, W. W. McDANIEL, AND R. R. DECKER
Standard Oil Co. (Ohio)

INSPECTION engineers at Standard Oil Co. of Ohio refineries are convinced that statistical analysis can save time and money if properly applied to refinery inspection work. The technique is used to more accurately estimate corrosion rates and equipment life. It's particularly rewarding in the following areas:

. . . **On piping circuits,** well-planned sample thickness measurements show the condition of entire systems.

. . . **Thickness** variability in new piping and steel plate are determined for use in corrosion-rate analyses.

. . . **Thickness readings** on tanks and vessels yield more useful information than spot checks at established inspection locations.

. . . **Corrosion rates** of furnace tubes are put on control charts, since each tube need not be inspected individually.

. . . **Recommendations** to management are more acceptable, factual, and the risks more accurately stated.

Here are a few examples showing how these statistical methods have been applied.

Furnace-Outlet Lines

High-temperature sulfur corrosion in more than 600 ft. of 8 and 16-in. crude-oil transfer piping on twin crude-oil units caused concern in spite of the fact that corrosion rates were assumed to be known and under control.

Adapted from a paper presented to a session on tubing inspection and maintenance during the twenty-fifth midyear meeting of the API's Division of Refining, Detroit, May 10, 1960.

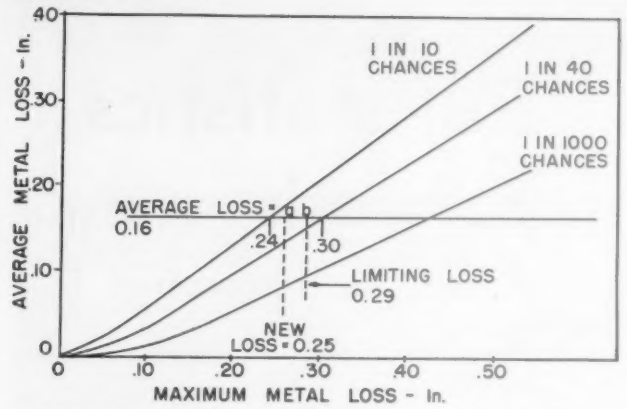
From 1952 to 1957, continuous records of piping-thickness measurements on the No. 1 crude-oil unit showed an average 5-year rate of 0.022 in. per year based on five test locations and the 1957 average wall thickness of 0.37 in. Originally, the piping was 0.48-in. wall carbon steel and the minimum allowable thickness was 0.19 in.

In May 1959, the installation of pipe flanges in an 8-in. pipe section at the No. 1 crude-oil unit provided a new inspection location. Pipe-wall caliper readings of 0.24 and 0.23 in. at this point were disconcerting. They meant that the 7-year rate was a maximum of 0.036 in. per year and the average wall had become 0.29 in. for the seven data points.

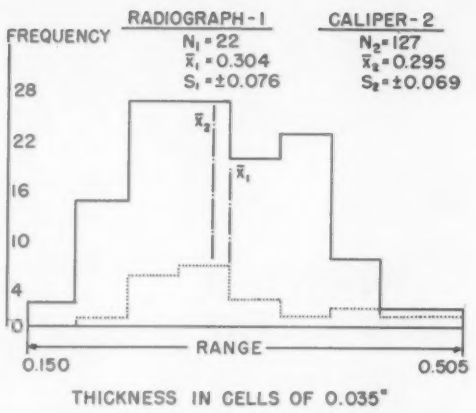
Using only the original five data points, the May 1959 readings seemed to verify the assumed corrosion rate of 0.022 in. per year at their average thickness of 0.32 in. Resolution of the discrepancies depended upon the answers to four questions:

1. Were more rapid corrosion rates encountered between 1957 and 1959?
2. To what extent were previous inspection points representative of corroded conditions?
3. What was the actual condition of the system?
4. When would retirement be necessary?

Considering item 1, it was easy to



FURNACE-OUTLET LINES. Relationship of average and maximum metal loss for various probability levels. Fig. 1.



RELATIONSHIP of radiograph and caliper readings on crude-oil furnace-outlet pipe. Fig. 2.

show that a rate of 0.075 in. per year, based on 0.23-in. wall thickness, would have been necessary from 1957 to 1959 in order to have a 7-year rate of 0.036 in. per year.

Operating conditions showed no radical changes in that 2-year period to account for nearly four times the increase in rate. Neither had furnace tubes shown any apparent change.

To answer item 2, the May 1959 measurements of the original locations were averaged. Limits were determined by plotting them on an "average versus maximum metal loss chart" developed by a member of Sohio's operations research group, and illustrated in Fig. 1. The ordinate was the average metal loss and the abscissa was the maximum probable loss. Three curves originating at zero defined their estimated relationship at various probability levels.

A line representing the average loss of 0.16 in. in 7 years for the original five data points (0.48 in. minus 0.32 in.) was drawn to intersect the probability curves.

At the first intersection, the maximum thickness loss could be 0.24 in. on the basis of 1 chance in 10. The second intersection predicted a maximum loss of 0.30 in. at a probability level of 1 in 40.

Therefore, minimum thickness measurements of 0.18 in. (0.48 in. minus 0.30 in.) might be expected on the assumption that this chart represented the system under question.

Working backwards by drawing a vertical line at the newly observed maximum loss of 0.25 in. 0.48 in. minus 0.23 in.), the intersection with the five-data-point horizontal line occurred at chances of about 1 in 20.

It would not be an unusual occurrence to pick these five data points from the population as a whole. There were simply too few points to establish a workable estimate of the standard deviation. (Computation of standard error of the standard deviation and the standard error of the mean would also confirm this conclusion.)

Item 3 referred to the actual general condition of the piping systems. Isotope radiography was used to more clearly define the extent of corrosion. Results of this work, as described below, established a more or less immediate retirement date for the No. 2 crude-oil-unit transfer line and answered item 4.

Thickness by radiograph. Radiograph measurements were taken at 26 locations (48 measurements) while the crude-oil units were in service. These radiographs were taken in such a manner that inferences could be made about the systems on both No. 1 and No. 2 crude-oil units. Frequency plots of the resultant data were made.

Average thickness computed was 0.328 in. with a standard deviation of 0.0778 in. for both units. Now a minimum thickness of 0.17 in. at both units could be expected at two standard deviations below the mean, or roughly 1 chance in 40.

By separating the data so the units could be compared, it was found that the crude-oil transfer piping on the No. 1 unit was heavier in wall thickness than that on the No. 2 unit:

No. 1 unit—average 0.348 in.; standard deviation 0.075 in.; minimum at 2 sigma 0.19 in.

No. 2 unit—average 0.304 in.; standard deviation 0.076 in.; minimum at 2 sigma 0.15 in.

Both units—average 0.328 in.; standard deviation 0.078 in.; minimum at 2 sigma 0.17 in.

Immediate replacement was recommended for the No. 2 unit piping and on the No. 1 unit, piping was scheduled for replacement in 6 months.

Calipered thicknesses. Cutting and measuring the No. 2 unit's 8-in. furnace outlet lines and the 16-in. header when they had been replaced gave the opportunity to check previous radiograph measurements by providing more extensive coverage of pipe-thickness measurements.

Ten sections were cut from the 70-ft. 16-in. horizontal header. Thickness measurements were taken at the 20 available ends with hand pipe calipers. Four minimum readings were recorded at each of the top, bottom, and side locations for every cut end. All four 8-in. furnace outlet lines were cut and 52 minimum measurements obtained on these for a total of 127 thickness data points.

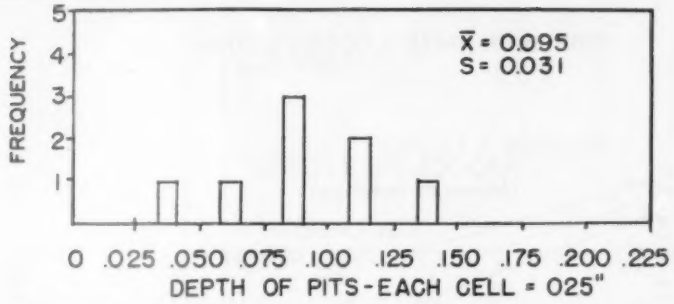
All measurements were plotted on a frequency diagram. The mean of these measurements was 0.295 in. and the standard deviation was 0.068 in.

Fig. 2 shows the relationship between sample radiograph readings on the No. 2 crude-oil unit and the caliper measurements. On the basis of engineering judgment, it was assumed that the latter were more representative of the true distribution of line thickness. The block diagram shows that previous estimates of average thickness and minimum thickness based on the No. 2 unit radiograph measurements properly predicted replacement. Radiograph samples never produced the minimum readings obtained by calipering; yet, predictions made from this sample were accurate.

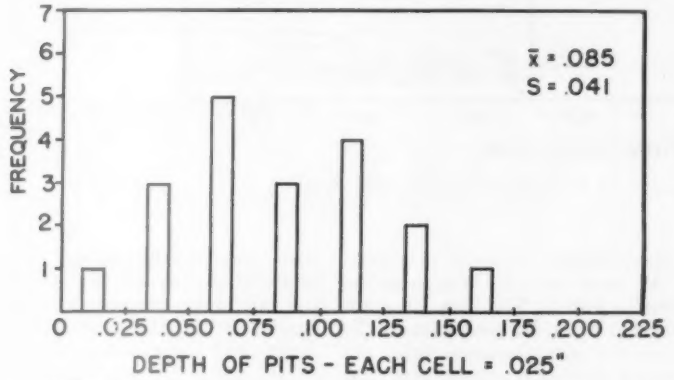
Results. This study revealed:

1. Standard deviation of the pipe-wall thickness when new, in 1952, was ±0.011 in. Corrosion had caused this to increase to approximately ±0.068 in. in 7 years.

2. The maximum 7-year corrosion rate was 0.047 in. per year (0.48 in. to 0.15 in.). However, even after 7



FREQUENCY DISTRIBUTION of maximum pit depths from samples taken from the bottom of a lube-oil tank. Fig. 3.



FREQUENCY DISTRIBUTION of maximum pit depths from samples taken from two tanks a year later than those in Fig. 3. Fig. 4.

years, some locations remained at original thickness. Therefore, all corrosion rates existed in the piping system, from zero to 0.047 in. per year. Distribution of these rates would correspond exactly to the distribution of thickness measurements.

3. Originally the established inspection locations were inadequate for the corrosion encountered. However, at a very low cost, approximately $350 for 26 radiographs, the condition of the lines was well established. Caliper measurements verified the importance of sampling technique in this problem.

4. Radiograph data showed that the No. 2 unit was the immediate problem and pointed the way to proper maintenance planning.

5. Statistical knowledge of data procurement and evaluation relieved the uncertainty and guess work usually accompanying this type of refinery situation. Inspectors knew exactly what to recommend and why. Only a minimum of discussion and explanation to plant management was necessary to start the replacement planning activity.

Tank-Bottom Failures

Early in 1958, a leak was detected in the bottom of a noncorrosive lubricating-oil tank. On inspection three small holes were found. Failures were attributed to galvanic corrosion resulting from clay in the sand pad. Two major questions:

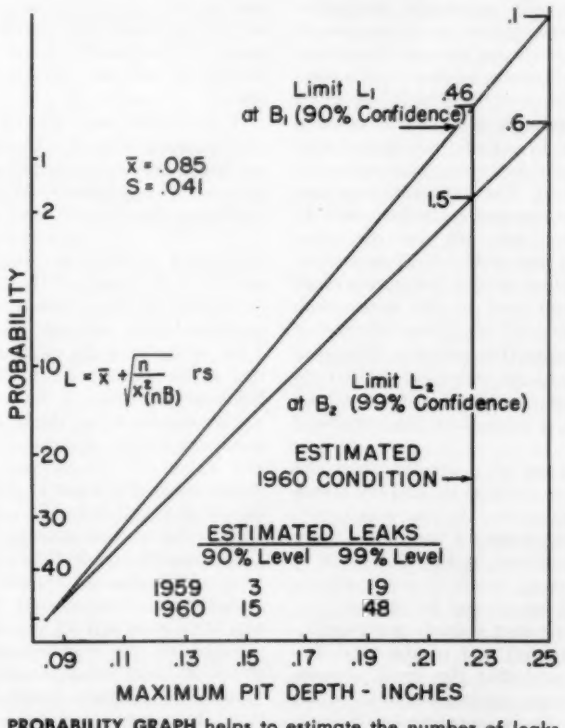
1. What is the present general condition of this tank? The answer to this question was needed so that necessary repairs could be made and the tank returned to service as quickly as possible.

2. What future maintenance will be required on this tank and the other 12 tanks in this field which were built at the same time 8 years ago?

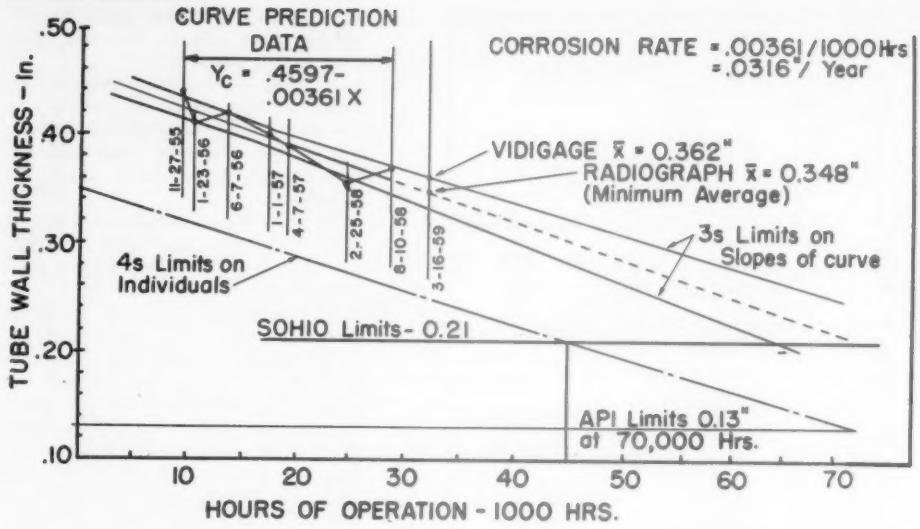
To resolve the immediate problems and gain basic information, eight 1-sq.-ft. samples were cut randomly from the bottom plates (0.25) of the tank which had failed. The maximum pit depth of each sample was determined. Fig. 3 shows this distribution. The mean maximum pit depth was 0.095 in. and the standard deviation was 0.031 in.

Based on a normal distribution, it was estimated that only 1 ft. in 10,000 sq. ft. would have pits penetrating the bottom. However, the tank bottom contained only 1,250 sq. ft. and already had three leaks. Obviously, either the mean or standard deviation was in error, probably the latter. Adjusting the deviation to account for what was already known, the standard deviation became 0.051 in.

From this it was estimated that approximately 28 sq. ft. of the tank had maximum pits of at least 0.200 in.



PROBABILITY GRAPH helps to estimate the number of leaks that can be expected both now and later. Fig. 5.



FURNACE-TUBE life can be predicted from corrosion plot. Fig. 6.

deep or a minimum thickness of 0.05 in. Inasmuch as the tank had been in service 8 years, many leaks were possible within the next few years. However, the general condition was good and only the sample holes and failures were repaired.

Because of the possibility of extensive failures, the conditions promoting electrolytic corrosion in this field were investigated. Apparently the problem was primarily dependent upon how much clay had been dragged on to the sand pad during fabrication.

No method was known for the positive detection of local cells, short of failure. Nevertheless, it was possible to design a cathodic protection system to stifle further cellular corrosion if it existed. Two systems were designed for economic studies; one to protect the one tank, and the other to protect the field of 13 tanks.

In 1959, a similar failure occurred in a second tank in this same field.

Maximum pit depth was determined for each plate. The previous data were corrected to an estimated 1959 condition and combined with the new data. Fig. 4 represents this combined data.

The mean was smaller than the 1958 mean at 0.085 in. and the standard deviation at 0.041 in. was larger, thereby suggesting a somewhat more severe condition in the first tank to fail. However, with a small sample this could be caused by chance.

Realizing that failures were occurring at the tail end of the total distribution and that the small samples were subject to considerable error, tolerance limits were established.

This was done in accordance with an approximation formula, developed by A. Wald and J. Wolfowitz, as shown in Fig. 5. The limit lines are calculated from the sample mean **X**, sample size **n**, chi-squared value determined from the sample size and confidence level desired $\mathbf{X^2(nB)}$, probability **Y**, and sample standard deviation **S**. Confidence levels of 90 to 99% were selected.

In other words, if innumerable samples of the population were taken, 9 out of 10 times the actual extremes would fall within the lower limit and 99 out of 100 times within the upper limit.

These limits were plotted on probability paper (Fig. 5). The maximum pit depth per sample is plotted on the abscissa. The probability of occurrence is plotted on the ordinate.

At a 90% level, the probability of pit depths of 0.25 in. deep (failure) would be 0.1, and at the 99% level it would be 0.6. Therefore, with a combined tank area of 3,220 sq. ft., 3 to 19 holes were estimated within the limits described. Actually, five holes were found.

The maximum pit depth which will result in failure 1 year later, also, was calculated. A vertical line was drawn from this point to the intersection of the limit lines. The 1960 probability values then become 0.46 and 1.5 at the 90 and 99% levels. Therefore, the maximum number of estimated failures would not exceed 15 at a 90% level and 48 at a 99% level.

Although the questions promoting this study were not answered with certainty, the problem limits were defined by statistical techniques. Engineering and economic studies were then evaluated in relation to these limits. Based on potential failures of the two tanks sampled, a reasonable payout of cathodic protection of the entire field was determined.

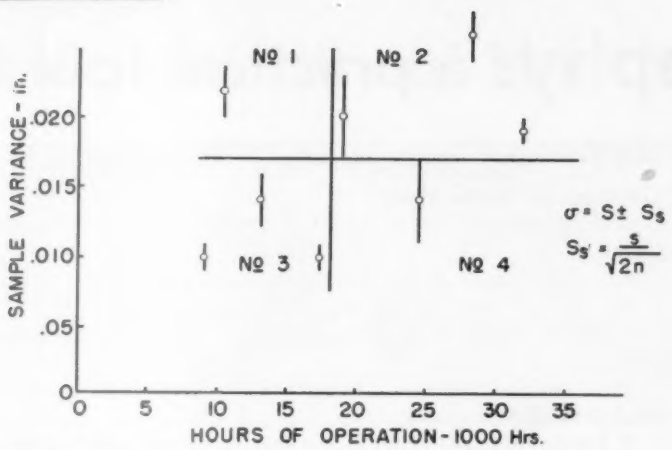
Reformer Pretreater Furnace

The pretreater furnace was the first all-welded furnace at the Lima refinery. Previously, all furnaces were of the rolled header box design permitting visual internal inspection and "miking" of the tubes inside diameters. Continuous records were maintained on the maximum inside-diameter measurements determined by an electric tube mike pulled through the tube. Except for eccentric corrosion or the installation of a tube pierced offcenter, this was a safe and satisfactory inspection technique. This method, of course, was impossible for welded construction and a new method had to be devised.

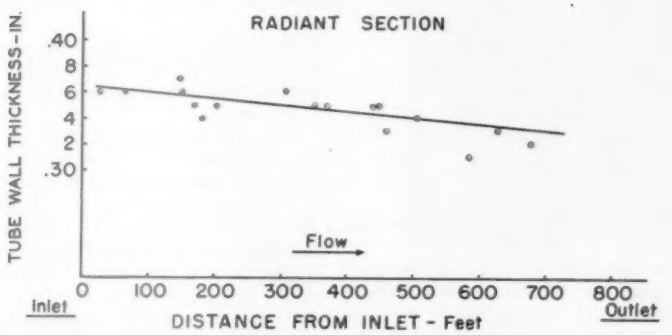
The method adopted consisted of taking random measurements with either Audigage or gamma-tron instruments on the fire side of the tubes. From 1955 to 1958, thickness surveys were made and a corrosion prediction equation was developed on the combined data.

Fig. 6 is a plot of tube-metal-thickness measurements on the Y-axis against hours of operation on the X-axis. The resulting corrosion plot was the least-squares regression line calculated from the total data with the average measurements located along it. This line was the best estimate of furnace-tube corrosion.

Corrosion rate. In addition to the mean corrosion rate, it was important



CHECK FOR variable corrosion rate by plotting sample variance versus time. Fig. 7.



BY KNOWING CORROSION TREND, inspectors can concentrate on most corrosive areas in future studies. Fig. 8.

to compare the data spread with operating time. An increasing variance with time would indicate nonuniform corrosion, which the average rate alone would not recognize. The expected nonuniform corrosion, if it existed, was hidden by sample errors in the prediction curve data.

Nevertheless, to be on the safe side, the lower limit line on the individual measurements was calculated at four standard deviations from the mean. To account for possible error in the slope of the curve, hyperbolic limits were determined as shown at three standard deviations or a confidence level of 99.6%. In other words, the probability that the true curve would fall outside these limits is only 4 in 1,000.

Projecting the best estimate of the corrosion rate into the future, the mean would be expected to reach the retiring limit for this 5% chrome material in approximately 70,000 hours. At this time, 50% of the potential measurements will be at, or below, the line. Based on the prediction data, the extremes will still be above the API stress-rupture limit at 70,000 hours.

In 1959, an extensive thickness survey was undertaken to gain experience on two new inspection techniques. One employed a radiographic examination of 28 locations. The other was a followup on most of these locations with the Vidigage survey. Sample coverage was more extensive with both methods than the single measurements previously made with the Audigage.

Radiographic samples were divided between fire side and top and bottom shots. The minimum measurements of each were acquired.

The Vidigage survey differed from the previous surveys because multiple measurements were taken at each location; four each on top, bottom, and fire side. The hard, tenacious, external oxide scale, previously removed to obtain Audigage measurements, was not disturbed for radiographic or Vidigage inspection.

Mean thickness for the radiographic and Vidigage samples was calculated at 0.348 and 0.362 in., respectively. Both measurements fall above the estimated corrosion curve.

The radiographic samples, being more selective and conservatively biased on the thin side, would be expected to fall somewhat below the true curve, while the Vidigage mean would be expected to fall above the true curve because of the scale effect.

However, no conclusion was reached as to what these measurements mean in terms of the accuracy of the estimating curve. Actually, both methods will be used in the future because they were more satisfactory from an inspection standpoint than the previous method. Further sampling will be required to establish confidence limits on these methods.

Variable corrosion. Earlier in the paper mention was made of an increase in variance with time. A plot of sample variance against hours of operation including the new Vidigage data is shown in Fig. 7.

The variance value is at the midpoint of the bars. The distance to either end represents confidence levels on these values determined from the variance and sample size.

To check for trend, Fig. 7 was divided into quadrants. An upward trend is suggested but was not found to be statistically significant at this time, thus, variable corrosion rates within the system were not apparent.

Another check on the hypothesis that variable corrosion rates existed was made by plotting the tube thickness along its flow path. Fig. 8 illustrates this effect.

In this case, a significant trend was found and a least-squares regression line best satisfying these points was drawn. Limits can be calculated for this line but they are not as important as the fact that a regression does exist. Knowing this, future inspection can be concentrated in the most corrosive area.

Future study. To better understand the mechanism of corrosion in this furnace and to achieve optimum tube life, the following studies are planned:

1. Continue random sampling to develop a mathematical model for the average tube corrosion rate.
2. Study effect of variance with time.
3. Investigate the significance of the different levels of corrosion with respect to the process and economics of partial versus total replacment.
4. Investigate the circumferential effect on corrosion patterns. Both Vidigage and radiographic measurements suggested greater corrosion to the fire side of the tubes.

Radiography: a practical tool for

Here's a quick summary of some of the advantages:

- Reduces down time.
- Does not require removal of insulation or sheet-metal covering.
- Can be used on hot uninsulated equipment.
- Does not require opening of flanges.
- Determines if it is safe to continue operation of equipment.
- Allows inspection of internals not accessible to other inspection methods.
- Frequently can determine what is wrong when equipment is not functioning properly.
- Can follow closely the progress of corrosion, erosion, and other deterioration of equipment.

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and T. ARNESEN
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THE GOAL of all refinery inspection departments is to furnish operating men with enough reliable information on the condition of equipment so that only scheduled shutdowns will occur. Radiographic inspection can make this goal possible.

Inspection methods require the use of radioisotopes, film sensitive to gamma radiation, and some knowledge of trigonometry. Large areas can be covered with one exposure.

Radiographic techniques can be used to determine tower tray position and amount of fouling or deposits, or both, in heat exchangers and other equipment. They can also be used to determine thickness of the equipment wall, thickness of scale and coke, and depth of corrosion. They can be used on hot insulated equipment, and the resulting radiograph will provide a permanent record of the exact condition of the equipment.

Wall thickness. The basic theory for obtaining equipment wall thicknesses is illustrated in Fig. 1.

Wall thickness can be calculated easily by means of the similar triangles indicated in the figure. The position of the source and the film can be altered to fit almost any situation, and the wall thickness can be calculated by the use of appropriate trigonometric functions. In some cases on insulated lines, it will be necessary to apply a correction factor.

The image of the wall is recorded clearly on the film because the gamma rays must pass through more metal at this section than at any other point. More gamma rays are absorbed by this section and, hence, less are available for exposing the film. The image of the wall appears lighter than the remainder of the radiograph.

Presented to a session on tubing inspection and maintenance during the twenty-fifth midyear meeting of the API's Division of Refining, Detroit, May 10, 1960.

The approximate length of the longest chord that the rays must penetrate is 2½ in. on 6-in. Schedule 40 pipe and 4½ in. on 12-in. Schedule 40 pipe.

Iridium 192 and cobalt 60 are the radioisotopes most commonly used. Iridium 192 can be used for obtaining thicknesses of any size pipe up through 6 in. Cobalt 60 has more latitude and can be used for any size pipe. However, iridium 192 is considerably more portable than cobalt 60 because of the large amount of lead shielding required for most cobalt 60 storage containers.

Radiographic inspection of equipment could disclose one of three things: that it is safe to continue operation, that it is not safe to continue operation; or, that the equipment is corroded or eroded, or corroded and eroded, and is approaching an unsafe condition.

Fig. 2 is a radiograph showing that the equipment was in safe condition. Corrosion was suspected in this catalytic reformer line, but the radiograph gave visual proof that this section of the line was in good condition.

Fig. 3 is a radiograph illustrating that it would have been unsafe to continue operation of the equipment. By use of the radiograph, minimum thickness of this catalytic reformer line was calculated to be 0.09 in.

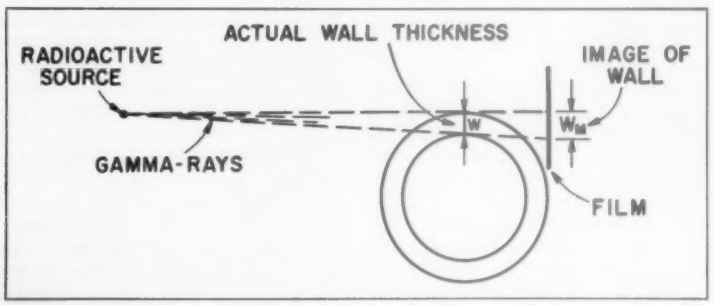
As a result, the operators shut down and the sheet-metal covering and insulation was removed from the line.

An ultrasonic instrument, used to measure the thin locations revealed on the radiograph, indicated that the line was 0.15 in. thick. Then a radiation-type instrument was used, and it indicated that the minimum thickness was 0.19 in. No doubt it was recording the thickness of steel plus most of the scale thickness.

Subsequently, the line was disassembled and sawed into sections. The correct thickness was then found to be 0.09 in., which exactly verified the radiographic findings.

It is obvious that the discovery of a thin line, such as the one shown in Fig. 3, can prevent serious fires and explosions. One finding of this nature will save enough money to pay for a radiographic inspection program for many years.

Radiographic inspection may reveal that equipment is corroded and may soon reach an unsafe condition. As a result, replacement equipment may be fabricated, purchased, or otherwise procured before the equipment is shut



WALL THICKNESS can be calculated by using the relationship of similar triangles. Fig. 1.

inspection without shutdowns

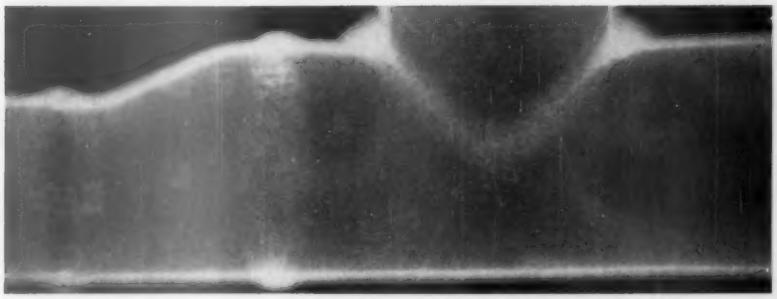


FIG. 2

Radiography showed this line was in good shape, but revealed that . . .

FIG. 3

this line had a thin spot, and . . .

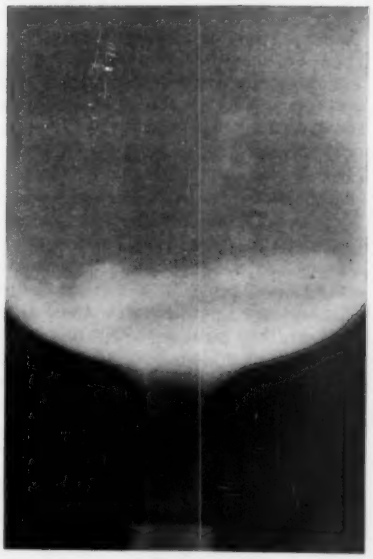


FIG. 4

this line had a dangerously thin drain nipple (plus an unsuspected bolt which someone had accidentally dropped inside)

down. This can prevent unscheduled shutdowns and shorten down time.

In many cases it will only be necessary to operate on bypass or to depressure for a few hours while replacement equipment is being installed. Fig. 4 is an example of dead-end corrosion.

The lower end of a gas pull header was radiographed for possible dead-end corrosion. The radiograph revealed that the small drain nipple was thin.

Inaccessible internals. Equipment internals are not accessible to normal inspection devices, but radiographic inspection can be used to determine their condition. (Fig. 5.)

An internal 2-in. pipe elbow is used to streamline the flow and prevent turbulence in the main line. The sketch is typical of eight identical alkylation acid-oil emulsion lines.

On several occasions in the past, this elbow has corroded away. When this happens, it is a very short time until the 10-in. line breaks through opposite the 2-in. inlet. Therefore, during the past few years, it has been our practice during shutdowns to remove the 10-in. elbows directly above this point for visual inspection.

In a case of this type, onstream radiographic inspection not only saves downtime but also saves the craft-hours involved in the removal and replacement of the 10-in. elbows.

Fig. 6 is a radiograph of a double-pipe cooler. Radiography is the only means of inspecting the internal tube. These tubes were in reasonably good condition, but it is possible to determine if corrosion, pitting, or scale is present on either surface of the smaller pipe or on the internal surface of the larger pipe.

RADIOGRAPH INSPECTION of this elbow in critical service helped save time and money. Fig. 5.

Malfunctioning equipment. When equipment is not functioning properly, radiographic inspection may reveal what is wrong. Then corrective steps can be taken.

A globe valve was used for throttling a tower reflux stream. During normal operations, it was opened one or two revolutions of the handwheel. A unit operator reported that he could open the valve but could not close it. He requested our help.

Radiographic inspection proved that the stem was disconnected from the plug. The plug was in a tilted position and enough oil was escaping for the unit to operate. This radiograph showed that if the valve had been opened more, the plug would have been forced away from the opening and the full flow would have resulted. The excessive amount of reflux would have upset tower fractionation. Orders were given that the valvestem setting should not be disturbed. This refining unit operated with the valve plug in this position until the next scheduled shutdown.

A report that it was impossible to obtain the proper vacuum on a vacuum ejector system offered an interesting problem.

Several radiographs were taken of the system. One radiograph disclosed that the diffuser throat was eroded and another radiograph disclosed that the inside bore of the steam-ejector nozzle was eroded.

New parts were ordered and subsequently the vacuum ejector system was bypassed while replacements were installed.

Weld-quality inspection. Although not a new idea, the use of onstream radiographic techniques for examination of questionable pipeline welds should not be overlooked as a real money saver.

At Standard Oil Co. (Indiana) Whiting refinery, questionable pipeline welds have been radioigraphed on several occasions while the refining units were in operation. Usually the quality of the welds was questionable because they were made before modern welding and inspection techniques were developed.

Most of the questionable welds proved to be adequate, but on two occasions onstream radiography indicated serious weld cracking. One of these involved a 16-in. rectifier vapor line on a gas-absorption plant. The other involved a ¼-mile 20-in. crude-oil line which provided the feed for several crude-oil refining units.

In both cases, several welds were cracked more than halfway through. As a result of this onstream radiographic weld inspection, new lines were fabricated while the old equipment was in service.

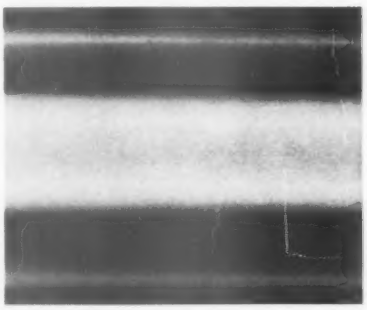
Replacement of the defective 16-in. vapor line was accomplished in the shortest time possible. The new 20-in. crude-oil line was laid adjacent to the old line and the final hookup of both ends required only a few hours.

Cost Savings

It is difficult to attach an exact figure to the amount of money saved by the application of radiographic onstream inspection techniques, but it is substantial.

This is particularly true when we consider fires or explosions that could have been eliminated with radiographic inspection, or fires or explosions, or both, that we believe did not happen because of radiographic onstream inspection.

Down time days may be valued from a few thousand dollars to several times that amount depending upon supply, demand, refinery integration, and other factors. Radiographic onstream inspection can reduce down time as follows:



ONLY MEANS of inspecting the inside pipe in a double-pipe cooler is radiography. Fig. 6.

1. Runs can be prolonged and some unscheduled shutdowns can be eliminated.

2. Prefabrication of replacement piping and the like can be accomplished before the shutdown.

3. Manpower, which otherwise would have been used for removing insulation and sheet-metal covering and for breaking flanges for inspection during the turnaround, is available for other shutdown work.

One cost which can be determined is the removal and replacement of insulation and sheet-metal covering for other inspection methods. This is estimated to be $10 to $20 for each point inspected. This one saving will pay for the radiographic inspection program. Longer runs, shortened turnarounds, and all the other advantages are extra dividends.

Safe, orderly, efficient

Startup-shutdown procedures

don't just happen—they're planned

Distillation units are increasing in capacity and size, tankage is being reduced or eliminated, and refineries are being streamlined. For the sake of safety, continuous operation, and minimum cost it will pay off to review your startup-shutdown procedures occasionally.

BY W. S. BONNELL AND J. A. BURNS
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THE OBJECTIVE on any unit is a safe orderly startup or shutdown which requires the least time and results in the least off-test products.

Procedures used at Gulf Oil Corp.'s Port Arthur refinery in a modern 120,000-bbl. per stream day West Texas atmospheric-vacuum unit accomplish this objective.

Here's a quick summary of how it's done:

1. The unit is purged completely of air, tested, and blown substantially free of water before startup.

2. Controlled recirculation is established through the atmospheric and vacuum sections following normal flow, with the towers maintained under controlled presssure. As the unit heats up, pump-suction trouble as a result of foaming does not occur.

3. The atmospheric section is fired, brought over, and lined up with recirculation of products. Circulation is continuing through the vacuum section. When the atmospheric reduced crude oil approaches proper composition, the vacuum section is fired, brought over, and lined up with recirculation of products. Inasmuch as recirculation is practicad during startup or shutdown, off-test products and excessive quantities of No. 6 fuel oil are not produced.

4. Since the unit is cut to the field with the unit lined up and products on test, downstream processing units are affected only slightly.

5. If a temporary crude-oil shortage or serious trouble on downstream units were to occur, the atmospheric-vacuum crude-oil unit could be put on recirculation in 2 to 3 hours and returned to normal operation in a short time.

Presented to a session on operating practices during the twenty-fifth midyear meeting of the API's Division of Refining, Detroit, May 11, 1960.

Startup Procedure

The cleaning and repair turnaround work schedule includes blanking and hydrostatic testing coolers, exchangers, and heaters. Only a nominal steam test is obtained on heaters during testing of the towers inasmuch as it was not feasible to provide transfer-line block valves. Prior to startup, the unit is checked for removal of blanks; the cooling-water supply inlet and outlet valves are closed; the headers, condensers, and coolers are drained; all bleeders in the unit are drained; and the pumpout connections are closed.

During purging and testing we accomplish considerable dehydration of the unit by heating and blowing water out with steam.

Atmospheric and vacuum-tower safety valves are set at 30 and 20 psi., respectively. With all coolers and condensers drained and by taking advantage of the safety-valve set pressures, sufficient steam pressure can be built on the atmospheric and vacuum sections to heat and blow the associated lines, exchangers, and coolers and to pump suction and discharge lines substantially free of water during testing.

Oil process flow is lined up through the unit by opening flow controllers and block valves. The atmospheric and vacuum sections are isolated, and the discharge valves in product pumps and at the product and recirculation manifold are closed.

Purging atmospheric section. Vents on top of the atmospheric tower, the reflux drum, and product drum are opened. Steam is introduced into the desalted crude-oil pump discharge, through the exchangers, through the heaters, and into the atmospheric tower. Steam is also introduced into the bottom of the atmospheric tower and in all strippers.

The desalted-crude-oil surge drum which vents to the atmospheric tower is purged and tested with the atmospheric tower.

Drains on the tower and drums and the bleeders on the exchangers, coolers, pump suction, and pump discharge lines are opened. Condensate is drained. When steam shows, the valves are throttled so that some steam continues to bleed out.

Vents on the tower and drums will indicate when purging of air is completed. Vent valves on reflux and product drums are closed, and the vent valve on the atmospheric tower is throttled so that pressure on the atmospheric section builds to approximately 25 psi.

While testing and tightening any equipment to eliminate leaks, operators continue checking drains and bleeders for condensate. Steam pressure of 20 psi. is held on the atmospheric section until testing is complete. By this time the drains and bleeders are showing only steam, and most of the water has been removed from the unit.

After the steam test is completed, tower pressure is reduced to 2 to 3 lb. by reducing the steam flow. Prior to gassing the tower, steam flow is out, and all vents, drains and bleeders are closed.

Gas is introduced into the atmospheric-tower product drum, and the atmospheric section is floated at 15 psi. The pressure controller on the gasoline accumulator is put in service, and enough gas is charged to the system to keep a small flow of gas through the controller to the flare. Bleeders and drains are checked at intervals to drain any condensate which accumulates.

The desalter is purged and tested by introducing steam into the discharge of the raw crude-oil pumps and venting the top of the desalter. When the desalter is purged of air, the vent valve on top of the desalter is partly closed to raise pressure to about 50 lb., and the system is checked for leaks.

The pressure is then released to approximately 5 lb., and steam is cut out of the desalter pump discharge. Vents and drains are then closed, and the desalter is pressured with gas from the atmospheric section.

Purging the vacuum section. The vacuum section is handled in the same manner as the atmospheric section. Purging and testing of the two sections can be done concurrently.

The first-stage ejector valves are closed, and the valve in the condensate leg from the overhead condensers is closed. The vent valve on top of the vacuum tower is opened. Tower drain and bleeders on exchangers, coolers, and pump suction and discharge are opened.

Steam flow is started at the atmospheric-tower reduced-crude-oil pump discharge through the heater into the vacuum tower. Steam is also introduced into the bottom of the vacuum tower and into the overflash drum. When drains and bleeders are free of condensate, the valves are throttled so that some steam continues to bleed out.

The vent on top of the vacuum tower is slowly closed to build the pressure on the vacuum section to about 15 psi. While testing, operators continue checking drains and bleeder valves for condensate.

After the test, steam flow is stopped and the pressure released through the steam ejectors, condensers, and drums via the noncondensable gas line. Releasing the pressure in this manner purges this equipment of air.

All bleeders, vents, and drains are closed; and the steam-ejector block valves are closed. Gas is introduced at the vacuum-tower overhead condensers and the vacuum section is maintained at 8 to 10 psi. with gas pressure.

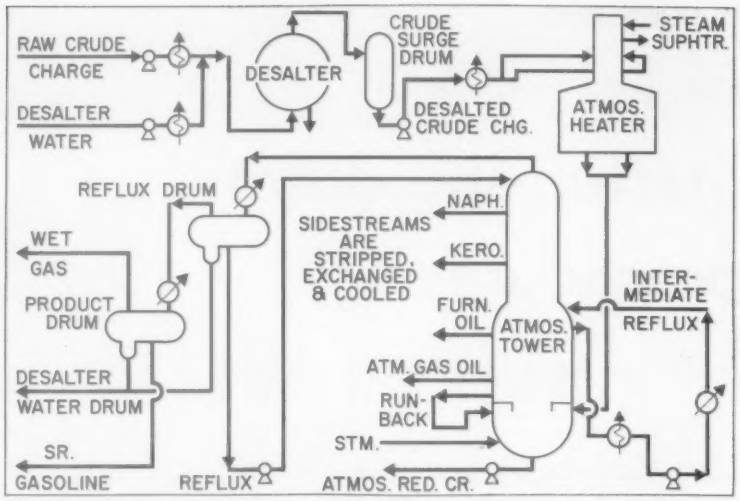
Cooling water is now started through the unit. The cooling-water return line is opened first, and then the inlet line is opened. Coolers are put on one at a time while air is being vented to eliminate possibility of an air hammer or surge.

Charging and Establishing Circulation

At this point the atmospheric tower and vacuum tower are purged, tested, and gassed up, and most of the water has been removed. The unit is now ready to charge and to establish recirculation following the normal flow of charge and bottom products.

Crude oil is charged from the crude-oil tank with the raw-crude-oil pumps to the desalter into the desalted-crude-oil surge drum.

The desalted-crude-oil pumps charge from the desalter surge drum through the exchangers and atmospheric heaters into the atmospheric tower. After high levels are established in the surge drum and the atmospheric tower, flow to the tower is stopped.



ATMOSPHERIC SECTION of 120,000-bbl. per stream day crude-oil-distillation unit at Gulf's Port Arthur refinery. Fig. 1.

The atmospheric reduced-crude-oil pump is then started to pump oil from the atmospheric tower through the vacuum heater into the vacuum tower. When this level is established, the atmospheric reduced-crude-oil pump is stopped.

A small amount of oil is then pumped from the bottom of the surge drum and the atmospheric and vacuum towers to remove any water that may have been washed into these vessels.

While charging and establishing circulation, the atmospheric and vacuum towers continue floating under gas pressure as previously described.

Circulation is now established at a rate of about 30,000 bbl. per stream day from the crude-oil surge tank with the raw-crude-oil pumps pumping to the desalter and desalted-crude-oil surge drum.

The desalted-crude-oil pumps take suction on the desalted-crude-oil surge drum and discharge through the exchangers and atmospheric heaters into the atmospheric tower.

The atmospheric reduced-crude-oil pump takes suction on the atmospheric tower and discharges through the vacuum heater into the vacuum tower.

The vacuum-tower-bottoms pump takes suction on the vacuum tower and discharges through the exchangers, bottoms coolers, and the product-manifold recirculation line to the raw-crude-oil suction line.

The vacuum-tower-bottoms pump capacity is limited to approximately 20,000 bbl. per stream day. Charge to the vacuum heater is limited to 20,000 bbl. per stream day, and the level in the atmospheric tower is controlled by using the startup line from the spare atmospheric reduced-crude-oil pump discharge to the heavy vacuum-gas-oil pump discharge.

This crude oil is routed through the heavy-gas-oil exchangers, coolers, and product-manifold recirculation line to raw-crude-oil suction. During this circulation, some crude oil from the atmospheric tower is charged into the vacuum tower through the intermediate reflux line to flush the lower trays of the vacuum tower and the overflash system.

The main pumps on the unit are now operating; flow through the atmospheric and vacuum sections is established with the crude oil recirculating to the raw-crude-oil pump suction. Flow recorders and level controllers involved are on control.

Inasmuch as continuous recirculation has been established, final dehydration will occur gradually as the unit heats up. With the towers floating under gas pressure, pump-suction trouble as a result of foaming does not occur.

While the atmospheric section is being brought over, circulation through the vacuum section continues, but the vacuum heater is not fired until the atmospheric section is over. However, final dehydration of the vacuum section is occurring, inasmuch as the vacuum-heater charge is increasing in temperature. With the vacuum section purged of air and floating on gas, this section is secure, and a minimum of attention is required.

Bringing atmospheric tower over

Since exhaust steam is superheated in part of the convection sections of all heaters, steam flow is established

through all steam superheating sections by venting these sections at the outlet of the heaters to protect tubes during startup.

The blanks are pulled in the atmospheric-heater-firing gas lines. The atmospheric heaters are then fired following the written procedure prepared for this unit.

Firing rate is controlled so that the atmospheric-heater-outlet temperatures increase about 100° F. an hour until 650° F. is reached.

While the same principles apply for firing different types of heaters, a specific procedure is required for each unit which provides for the actual design and layout of the heaters, burners, firing-gas lines, and controls.

When a level appears in the reflux drum, reflux is started to the top of the atmospheric tower. As the level builds in the product accumulator, gasoline level is maintained by starting product flow via the product-manifold recirculation line to raw-crude-oil suction. If the water level builds in the reflux and gasoline accumulator drums, it is drawn off to the desalter water drum.

As levels build in the naphtha, light-furnace-oil, heavy-furnace-oil, and atmospheric-tower strippers, the flow of these products is started via the product-manifold recirculation line to raw-crude-oil suction.

As the tower heats up and internal reflux and upper product sidestreams are established, the intermediate reflux bleeders are checked frequently and drained to remove any water. When the intermediate reflux circuit is free of water and light-furnace-product flow is established, intermediate reflux is started.

The level in the atmospheric tower is decreasing as products are removed from the tower. As this occurs, the flow of atmospheric-tower bottoms to the heavy vacuum-gas-oil pump discharge is reduced and cut off when necessary.

In order to maintain a 15,000 to 20,000-bbl. per stream day flow to the vacuum heater, the raw-crude-oil charge is increased to about 50,000 bbl. per stream day. Addition of gas to the gasoline accumulator is continued as required to maintain tower pressure and to keep the pressure controller operating.

The atmospheric tower is now over but still recirculating. Operating conditions are set to make on-test products. The desalter electrodes have been turned on as the desalter heats up. Some water has been removed and is accumulating in the desalter.

Bringing vacuum tower over. As the atmospheric tower is being brought over and recirculated, the vacuum-heater charge is approaching atmospheric reduced-crude-oil composition and is increasing in temperature. By the time the atmospheric tower is over, the bottom of the vacuum tower is above 400° F.

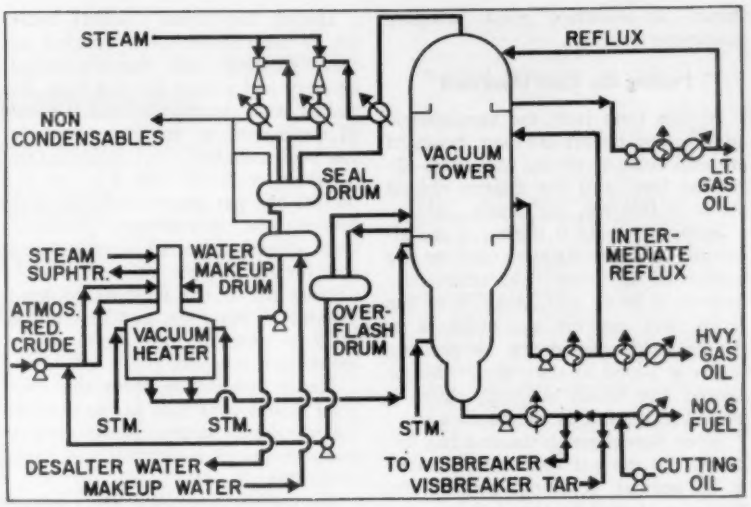
When the vacuum-tower pressure builds, the gas makeup is stopped. As tower pressure continues to increase, it is released by opening the valves in one set of steam ejectors. The valve in the overhead-condensate leg is opened as soon as the pressure is released. The tower is left under atmospheric pressure with a small flow of purge gas to the flare.

After atmospheric-gas-oil-product flow has been established, the light-vacuum-gas-oil tub is filled, using the common spare atmospheric gas oil-light vacuum gas oil pump, so that oil for top reflux is available.

The blanks are pulled in the vacuum-heater-firing gas lines, and the heater is fired following the specified firing procedure. The heater-outlet temperature is raised 100° F. an hour until it reaches 650° F.

Light-gas-oil reflux from the tub to the top tray is started as soon as the top of the vacuum tower approaches 212° F. While the vacuum section is being heated and internal reflux is being established, the heavy-vacuum-gas-oil intermediate reflux and product circuits and the overflash-system bleeders and drains have been checked frequently for water.

After the top section of the vacuum tower has become controlled by light-vacuum-gas-oil reflux and after intermediate reflux is established, vacuum is applied slowly.



VACUUM SECTION of atmospheric-vacuum-distillation unit. The tower is equipped with surface condensers and two-stage steam ejectors. Fig. 2.

Pressure is reduced by gradually putting steam to a secondary ejector and later to a primary ejector. Inasmuch as the tower has been floating under a slight gas pressure and inasmuch as stripping steam has not been added to the tower, the rate of pressure reduction is easily controlled.

Full vacuum is established slowly over a period of about an hour to maintain control of the tower. As condensate is made, it gravitates to the condensate drum which overflows into the desalter-water-makeup drum.

As the tower heats up and vacuum is established, the vacuum-heater outlet is increased to operating temperature.

Light-vacuum-gas-oil tub level is maintained by pumping the light-vacuum-gas-oil product via the product manifold-recirculation line to raw crude-oil suction. Heavy-vacuum-gas-oil product is started via the product-manifold-recirculation line to raw-crude-oil suction.

The overflash recycle to the vacuum heater and to the ninth tray is established and put on control. Operating conditions are set to make on-test products from the vacuum tower.

To maintain stable operation on the atmospheric section and to bring the vacuum section over, under control, it is essential to maintain the level in the bottom of the vacuum tower and a steady, although decreasing, flow of vacuum-tower bottoms. The vacuum-bottom control is put in service when recirculation starts. The level is recorded for easy reference.

As vacuum is applied and the vacuum tower approaches normal operating pressure and temperatures, recycle of exchanged bottoms for quench in the bottom of the vacuum tower is

started to maintain good pumping conditions.

Putting the Unit Onstream

At this time both the atmospheric and vacuum towers are over, products are recirculating to the raw-crude-oil-suction line, and the charge rate is about 50,000 bbl. per stream day.

Stripping steam is started to the atmospheric-tower strippers and to the bottom of the tower. The steam condensate is being withdrawn from the reflux and gasoline accumulators to the desalted-water drum. Vaporizing steam is added to the vacuum heater slowly, and finally stripping steam is started to bottom of vacuum tower.

Since flow through the unit has followed the normal route, the desalter is at normal desalting temperature. Water is started to the desalter, and the emulsion valve and the desalter-water-drawoff controller are put in operation.

All instruments and controllers are in service and put on control as soon as possible.

With the unit circulating at approximately half rate, with operating conditions established, and with the desired quality and quantity of products, the unit is ready to cut to the field. The crude-oil pump house has been notified that a given quantity of crude oil will be required, and downstream processing units have been notified that product will be available.

The products are then manifolded from the recirculation line to the regular product lines at the product manifold. Crude oil automatically starts from the crude-oil surge tank which is floating on the raw-crude-oil-pump suction.

Cutting oil is started to the inlet of the vacuum-tower-bottoms cooler just before the bottoms are cut to fuel-oil tankage.

As fresh crude oil displaces recirculated crude oil, wet gas is made. Makeup gas to the gasoline accumulator is cut out, and wet gas is manifolded to the common refinery gas plant.

Crude-oil charge rate is raised to 120,000 bbl. per stream day with operating conditions adjusted as required. After full charge rate is reached, vacuum-tower bottoms to the cooler is manifolded to the viscosity breaker which is fired, circulating and ready to receive hot charge.

Shutdown of the Unit

Pump houses and process units which will be affected are advised of the pending shutdown. Crude-oil rate is reduced to about 50,000 bbl. per stream day, and operating conditions are adjusted accordingly.

During this period viscosity breaking of the vacuum-tower bottoms has been stopped; the viscosity-breaker delivery and return line has been displaced with cutting oil; and the flow of cutting oil to the bottoms cooler has been adjusted.

When crude-oil rate has reached 50,000 bbl. per stream day, the pump houses and downstream processing units directly affected are renotified, and the unit is put on recirculation. Cutting oil to the bottoms cooler is stopped at this time, and the flow of makeup water to raw crude oil for desalting is stopped.

Steam condensate from the overhead drums continues to the desalter-water-makeup drum. Desalter-water-pump discharge is diverted to a closed sewer box.

During shutdown the lower section of the vacuum tower involving the heavy vacuum gas oil and bottoms circuits is flushed free of heavy viscous oil by circulating and refluxing the tower down. This makes pumping out and steaming out easier and more effective.

The vacuum-heater-outlet temperature is decreased at the rate of 100° F. per hour. Production of light vacuum gas oil has been stopped, and the amount of heavy-vacuum-gas-oil product is drastically reduced. Production of some heavy vacuum gas oil and circulation of intermediate reflux is maintained as long as possible. Top reflux is being continued.

When the vacuum-heater outlet reaches 500° F., the vaporizing-steam flow to the heater is reduced, and the fires are cut out. Vacuum on the vacuum tower is broken by stopping steam to the primary ejectors and then to the secondary ejectors.

Gas is added to the vacuum-tower-overhead condensers. The tower floats with a small gas flow to the flare. Light-vacuum-gas-oil top reflux is stopped when the level of oil in the tube cannot be maintained.

The atmospheric-heater outlet is decreased at a rate of 100° F. per hour. When the outlet temperature reaches 500° F., the fires are cut out.

Circulation is stopped, and the atmospheric and vacuum heaters are steamed into the respective towers using the steam connections at the discharge of the desalted-crude-oil pumps, the inlet of the atmospheric heaters, and the discharge of the atmospheric reduced-crude-oil pump.

Top reflux on the atmospheric tower has been cut out as required. Some gas is added to the product drum so that the tower is floating with a small gas flow to the flare.

Levels in the towers, overflash drum, and the shell side of the hot exchangers are pumped to slop. Yard steam of 125 psi. is now added to the bottom of the towers and to the vacuum-tower overflash drum.

The desalter is floated on the crude-oil surge drum by opening the back-pressure regulator, and the crude-oil surge drum, desalter, and the shell side of all coolers are pumped out.

Steam is added to the bottom of the crude-oil surge drum. The raw-crude-oil exchangers and desalter are steamed by adding steam at the discharge of the raw-crude-oil pumps.

Atmospheric reflux and product drums are pumped out to slop and continued as levels require.

At this point all equipment is steaming into its respective towers, and the towers are being steamed overhead. Steaming rates are increased; water on the overhead condensers is cut considerably; and the small amount of purge gas in the towers is cut out. If the towers build pressure, they are bled off to the flare line. Steaming continues for 6 hours.

Steam is cut out of each tower, and the respective overhead condensers are blocked and drained.

Each tower is then steamed for 2 hours out of the atmospheric vents at the top of the towers. When the towers are vented to the air, steam is added to the overhead drums so that they are steamed back through the drained condensers and vapor lines to the top of the towers.

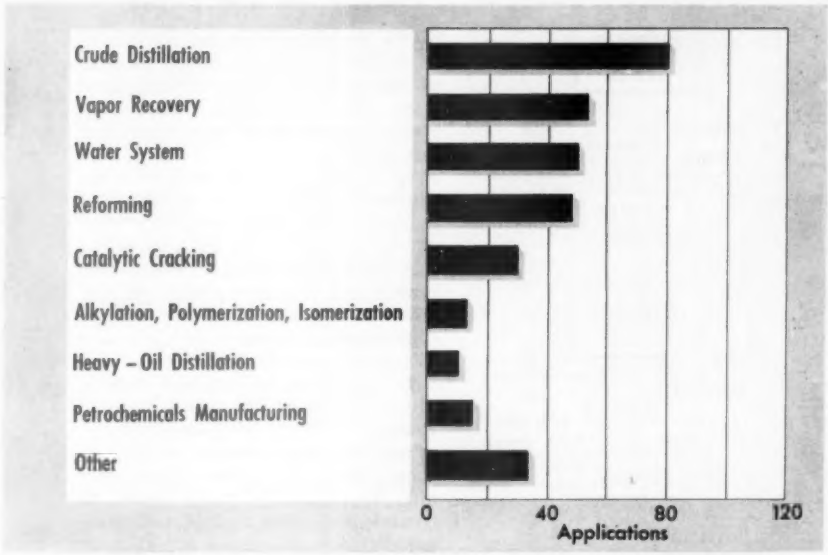
Steam is cut out, and the top head on each tower is removed. The towers are then steamed out of the top manheads for 4 hours. During this time all lines, exchangers, and drums are vented and steamed.

The vacuum-heater vaporizing steam and the stripping-steam flows are cut out, and the superheating coils in the connection sections of the heaters are blocked out and vented. When steaming is finished, the unit is ready for blanking and maintenance.

Time required. After mechanical work is completed, the unit is purged, tested, and gassed up in about 16 hours. The unit is charged, and recirculation is established in approximately 8 hours. The atmospheric and vacuum sections are brought over, and the products are ready to cut to the field in approximately 16 hours. Elapsed time between preparation for startup and products cut to the field is 36 to 48 hours. About 24 hours is required to shut the unit down and get it ready for maintenance work.

Acknowledgment

An effective startup-shutdown procedure is the result of close cooperation and planning by engineering and operating personnel. We wish to acknowledge this cooperation.



APPLICATIONS FREQUENCY for electrical resistance probes. More than 1,500 are in use in refineries on the North American continent. Fig. 1.

Probes prove talented corrosion sleuths

- API survey reveals widespread acceptance of this tool for combating refining's ever-present problem.

ELECTRICAL-RESISTANCE probes are now widely accepted in petroleum refineries for monitoring the corrosivities of streams; for helping to solve emergency corrosion problems; and for determining the optimum level of inhibitors, neutralizers, or chemical treatments for corrosion control.

In some locations, especially the overhead streams of primary fractionators of crude-oil-distillation units, the use of probes has become practically routine.

In making proper application of the probe method, consideration must be given to selecting the probe location, material, surface treatment, and frequency of probe readings; to interpreting the shapes of the corrosion-versus-time curves; and to safety aspects. Probe-entrance ports should be standardized.

These are conclusions determined from an API survey. Replies were received from 45 refineries of 24 oil companies. Andrew Dravnieks, Standard Oil Co., Indiana, reported on survey results at the API Division of Refining meeting, Detroit, May 9.

Objectives. With the probe method, the corrosivity of a refinery stream can be evaluated rapidly under actual process conditions to meet two general objectives:

1. To find out what is going on in a unit.
2. To regulate corrosion control.

Table 1 shows the distribution of typical objectives mentioned in the surveys, based on the dominant purpose in each case.

Distribution by processes. More than 1,500 probes are in use in refineries on the North American Continent. They have found applications in almost every type of process, as shown in Fig. 1. The greatest number of applications was in crude-oil-distillation units; 35 of the 45 refineries surveyed used probes in at least one crude-oil-distillation location. Vapor-recovery units, water systems, and reforming units were the next-most-frequent locations of use. In fact, the figure gives a fair indication of the relative frequency of corrosion problems which occupy refinery corrosion people.

TABLE 1
Reported Objectives of Probe Use

Motive—	Frequency cited %
To Learn What Is Going On	
Monitor for corrosivity surges	18
Determine approximate corrision rates rapidly	16
Study influence of changes in stream composition	10
Investigate emergency problems	10
Test substitute materials	8
To Regulate Corrosion Control	
Experiment with inhibitors in process streams	15
Adjust the levels of neutralizers and inhibitors	12
Experiment with water treatments	7
Adjust process treatments such as desalting	4
	100

In crude-oil-distillation units, probes have been used almost every place, as indicated in Fig. 2. The most common usage was in the overhead system of the primary tower where corrosion is severe unless some means of corrosion control—most commonly neutralization and inhibition—is used. Probes are used routinely as guides to maintain the most economical level of neutralizer and corrosion inhibitor.

Application to the overhead of vacuum towers is similar, but the per cent use in vacuum units was lower because there are fewer vacuum units.

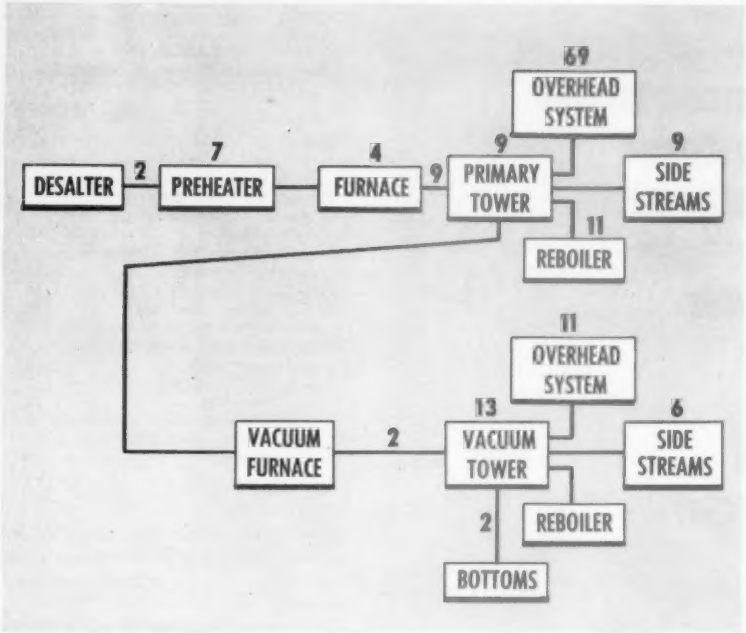
The approximate distribution of probe applications in vapor-recovery units is shown in Table 2. Probes are widely used in both the depropanizer and the debutanizer overhead systems to monitor corrosion control by neutralizers and inhibitors.

TABLE 2—Probe Applications in Vapor-Recovery Units

Feed section (before and after gas compressor; depropanizer preheater)	4
Towers (practically all towers)	8
Reboilers	9
Overhead systems (predominantly on depropanizers and debutanizers)	20
Strippers	5

In reforming and in catalytic cracking units, probes are used in the overhead systems of prefractionators, depropanizers, debutanizers, and other towers, and in the light-ends-recovery section. Other locations are the regeneration system and in furnaces of reformers.

It is difficult to maintain the water in refinery cooling systems in a state of low corrosivity. Probes placed in basins, lines, and heat exchangers have guided the selection and maintenance



CRUDE DISTILLATION accounts for more probe applications than any other process. The numbers refer to per cent of 45 refineries reporting use of probes in their indicated locations. Fig. 2.

of the type and level of chemical treatment. Corrosivity of steam condensate also has been tested in several refineries. Other applications found by the survey are listed in Table 3 and testify to the versatility of the probe method.

Operational range. Probes may be used in systems that contain dangerous substances at high temperatures and pressures. There are many successful uses above 400° F. One application is at 1,000° F.; four are installed between 800° and 1,000° F.; and eight probes are used between 600° and 800° F.

Fig. 3 summarizes the highest pressures at which probes were used. With the retractable probes, the limitation is not only in the pressure-resistance of the seal, but also in the need to push the probe against the vessel or pipe pressure. Apparently, with a mechanical device, probes could be inserted against pressures of several hundred pounds per square inch. Some locking device should be used to prevent expulsion of the probe. One refiner uses a self-made device, based on a threaded-rod principle, to operate retractable probes at 300 psi. and 500° F., or 450 psi. and 150° F.

Frequently, it is inconvenient or hazardous to have the probe-reading instrument close to the probe. With an extension cable the probe readings have been made at distances up to 250 ft.—well outside of the hazardous zone. Long cables permit reading in a centralized location, such as in the control house; two refineries reported using centralized probe-reading systems on some units.

Probe placement. To give useful data, corrosion probes should either reproduce the corrosion rates of the equipment reasonably well, or at least follow the changes in the corrosivity of the stream. Therefore, the location of the probe must be selected carefully. The most important need is to properly represent the temperature and the velocities.

As an example, the walls of heat-exchanger tubes are at temperatures either lower or higher than the stream, and to reproduce the rates at which they corrode is difficult. With two probes, one placed upstream and the other downstream of the exchanger, wall conditions sometimes have been successfully interpolated.

In condensers of overhead systems of crude-oil units, the corrosive phase consists of water with dissolved hydrogen chloride, hydrogen sulfide, and some oxygen. This phase appears only after the steam is cooled below its condensation point, and then it gradually changes in composition as more water condenses. A probe placed at the point where the condensed phase is present usually indicates the corrosivity of the stream and can be used to control neutralization and inhibition.

Probes usually are located more or less in the stream, so the velocity of the corrosive medium seen by the specimen usually is higher than that seen by the walls and corresponds more to the conditions in bends than in straight pipe. Thus, in media in which corrosion is sensitive to velocity a probe may corrode faster than the walls of a pipe or the bottom of a drum.

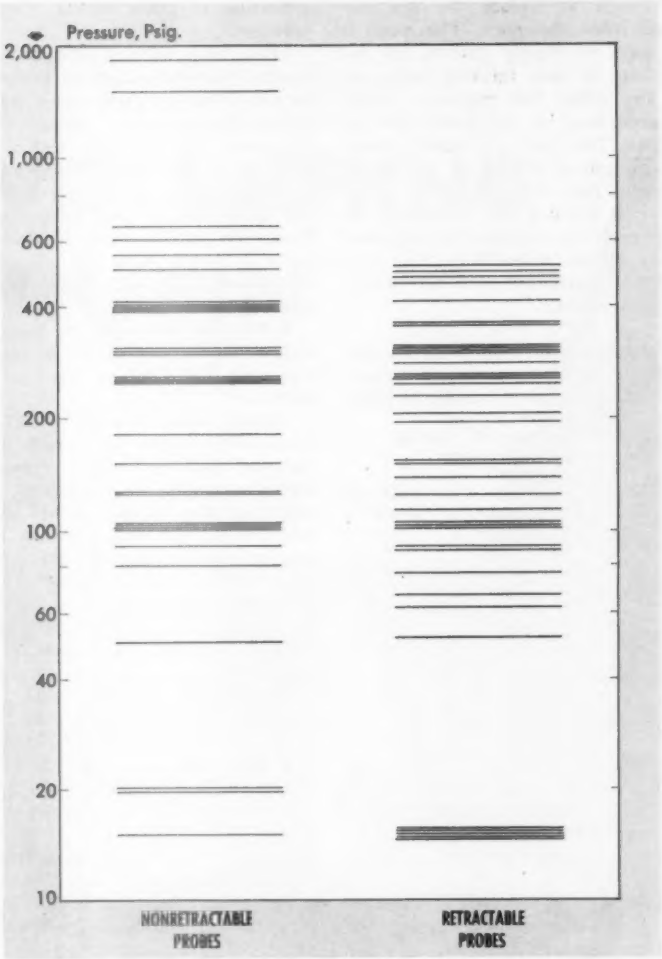
For example, when a condensed-water phase is expected to be the principal corrodent, the location should evaluate the worst combination and should incorporate turbulent conditions, a substantial amount of water phase, and the highest temperature possible. The corrosion rates of the probe are then higher than those in other parts of the system. Nevertheless, the relative changes in the corrosivity of streams with operational variables or treatments are indicated, and the success of corrosion control by neutralizers and inhibitors is more noticeable and more readily attainable.

Sometimes probes are placed in the water drawoff from the overhead system. However, if steam is used in the distillation, the corrosive components in this location may be diluted; also, velocity and temperature effects are represented poorly.

Probe material. Except when corrosion is evaluated by actually inspecting the equipment after a run, the problem of reproducing faithfully

TABLE 3—Other Locations of Probes

Process and location in process	Applications
Coking units (other than in crude-oil-distillation sections):	
Stabilizer overhead; evaporator drums	2
Alkylation (sulfuric acid):	
98% acid line; reactor emulsion circuit, line from the settling drum to the reactor; feed preheater; feed to debutanizer; tower; depropanizer overhead	7
Alkylation (HF):	
Debutanizer-tower overhead	1
Isomerization:	
Converter effluent; finished product	2
Doctor treatment:	
Reactor effluent	1
Solvent extraction:	
Rich solvent line; reboiler; solvent-distillation overhead	3
Catalytic polymerization:	
Reactor product; overhead from regenerator	2
Miscellaneous:	
Hypochlorite naphtha-treater distillate	1
Flue gases	1
Cathodic protection of open water boxes	1
Storage of sour naphtha: water and vapor phases	2
Caustic scrubbing; additive manufacture (feed, product, overhead); detergent alkylation (benzene recovery); gas plant; asphalt ($FeCl_3$ addition); crankcase of engine	>10



HIGHEST PRESSURE at which probes were used in the surveyed refineries. Fig. 3.

the materials of equipment walls is common in any corrosion testing. Surface conditions also are important in some tests, especially with ferrous metals and alloys in media of low or moderate corrosivities. In the presence of oxidants, these materials may exist in a so-called passive surface state, as distinguished from an active, or corroding, state.

Passivity established in air sometimes persists in a slightly corrosive cooling water for many days until a spontaneous electrochemical triggering activates the surface. For practical purposes, the best method to destroy the passivity is to dip the probe for a few seconds in dilute hydrochloric acid and wash amply with water.

Interpretation of measurements. Inspection measurements and coupon data are averages obtained over long ranges of time. The probes give short-range data, which must be totaled and averaged to obtain numbers comparable to the long-range result. Where the changes in corrosion rate are small, the average rates indicated by probes usually agree with other data, except where the probe material and conditions did not properly represent the equipment walls. Where corrosivities change rapidly or protective films form, there may be disagreement.

A reverse situation occurs in some cooling waters where pitting is the normal mode of corrosion. A probe may remain passive for a long time and indicate zero corrosivity, but then may indicate a **sudden** rapid corrosion when an active pit develops. Visual inspection of the probe will reveal the pitting.

Fluctuations in readings have been observed on many occasions and for several reasons. Some fluctuations were trivial and related to manufacturing defects, mishandling of probes during installation, and corrosion of contacts in connectors.

Temperature is a more significant cause of fluctuations. When the temperature changes rapidly, the corroding specimen follows the change more closely than the protected specimen. Unsteady readings and poor resolution result, and to improve resolution more readings are necessary. From an average of many fluctuating readings obtained with sensitive recorders, reliable corrosion curves can be plotted and the corrosion rates can be calculated for short-time intervals.

One-fourth of the refineries encountered probe data which were thought to be in conflict with other evidence. Although comprehensive studies of such discrepancies were not conducted, several cases which were investigated pointed either to some of the difficulties just discussed, or to simple misunderstandings. Thus, occasional complications have not detracted from the over-all usefulness of probes.

Safety aspects. Because the probes use electrical current and are mounted through seals, electrical and leak hazards potentially exist.

The electrical nature of the technique requires caution in any location where explosive gas mixtures may exist. In the commercially available probe systems, laboratory tests indicated that a spark that would ignite explosive mixtures of the type encountered in refineries did not result when the specimen or lead wires were broken. Instruments now in use also should not produce a dangerous spark under normal circuitry conditions.

Nevertheless, any complex instrument that is not functioning properly may create a safety hazard. In certain locations, probes are never permitted in 7% of the refineries, and instruments are never permitted in 5%. One-third of the refineries imposed no restriction on the use of instruments, either because the instruments had not been in dangerous locations, or because insufficient consideration had been given to the problem.

Restrictions on the operation of the instruments in certain areas are sound practice and should be retained. The restrictions usually require either routine or spot tests for gas in air whenever the instrument is to be operated where dangerous concentrations of flammable gases might occur.

Some refineries place a piece of dry ice in the instrument case to expel the air. This practice may be objectional because the resultant cooling may lead to condensation of moisture and cause corrosion and electrical leakage. The best practice might be to use a long cable and place the instrument outside of the danger zone.

The seal feature of probes also has given some concern, because leakages have occurred. In eight refineries, the possibility of leakage was sufficient to rule out probe tests where the leaking substance might be especially dangerous—for example, in some parts of hydrogen fluoride alkylation units. This difficulty might well be eliminated by further advancements in probe technology and experience.

In four cases, retractable probes were expelled through the packing gland unexpectedly; luckily, these accidents did not result in injuries. The internal pressure in the vessel can expel a retractable probe despite the friction in the packing gland; therefore, use of a simple chaining or safety-clamping of the protruding stem, as well as a safety device on the specimen end of the probe, should be an absolute necessity. A clear realization of the pressure effect when the probe is inserted or removed is also necessary. The use of mechanical traction devices may be advisable.

Probe programs. The operation of probes in refineries usually is in the hands of those groups most directly concerned with corrosion. In only two cases did the operators of process units administer the probe program. In 60% of the refineries, the programs were handled by engineering, inspection, and maintenance people; in the rest, by laboratory or research people. For an effective program and the most beneficial utilization of results, close cooperation among operators, engineers, inspectors, and process chemists is much more important than who has basic responsibility.

In companies with several refineries, the use of the probe pool, such as is used in one large company, seems to be advantageous. Corrosion problems of a critical nature often become apparent suddenly, either during a shutdown for a turnaround or by the failure of a piece of equipment during operation. The pool has made possible many tests that, because of time limitations, never could have been conducted if probes had had to be ordered in a routine way.

The pool operates as follows: the corrosion section in a central department maintains a supply of corrosion probes of the most popular sizes and materials. If an urgent corrosion problem arises, a simple phone discussion establishes whether a probe test is desirable. A probe from the pool may be dispatched at once, cutting across the usual red tape involved in requisitioning purchases and the like.

The refinery eventually provides a new probe to replace the one obtained from the pool. The pool is not used to supply probes for installation in new refinery units, or for any other test purposes where the need may be anticipated well in advance. The pool also cannot maintain a supply of probes for specialized corrosion tests requiring rarer probe materials. Table 4 lists the use of the probe-specimen materials as indicated by the survey; it could be used as a guide to the relative need for various probe materials.

Standardization. This is another means to facilitate testing programs. For testing in closed vessels or lines, an entrance port must be used through which a probe can be inserted in such a way that the specimen will be in the process stream close—but not too close—to the inner surface of the equipment.

TABLE 4—Usage of Materials for Probe Specimens

Metal	Refineries Reporting Use
Carbon steel	45
Admiralty metal	16
Austenitic stainless steels	9
Monel	6
Brass, bronze, cupronickel	6
Aluminum	6
5 to 9% Cr steels	6
Carpenter 20	6
Hastelloys	3
Others (titanium, nickel, copper)	3

More than 40% of the refineries experienced difficulties in finding suitable entrances in locations where a test was desired. There were two main reasons for these difficulties: no entrance ports at the desired location, or an entrance port requiring a special make of probe. The logical way to work toward a solution of this problem is through standardization of probe entrances and probe types. Once the probe entrances are standardized in a manner satisfactory to the petroleum industry, suitable standardized probes should become available.

Entrance ports at every place where a corrosion test possibly might be desired would be impractical. However, in certain locations where use of probes has become almost routine, it appears wise to plan from the very beginning to provide any new equipment with probe entrances at the time of construction. In older units where some ports already may exist or may be improvised, the temporary use of special probe sizes to fit these ports seems reasonable. However, wherever regularly replaceable probes have to be used on a routine basis for the foreseeable future in old equipment, or new probe entrances have to be installed, standardization of ports should offer advantages.

More than 60% of the refineries favored standardization of probe entrances. The arguments against standardization were a desire to use entrances now available and a fear that a standardized entrance—and correspondingly standardized probes not acceptable to some particular refinery—might be imposed. However, on a long-term basis the advantages of entrance-port standardization are obvious.

Before the entrances are standardized, some decision should be reached regarding the type or types of entrances.

Probes, other than dip probes, can be attached either by flanges or by threaded fittings. Flanged probes are more expensive, and opinions were expressed that flanged probes should be reserved for high-pressure high-temperature service. Direct attachment with threaded fittings without a block valve is not permitted in some refineries, because a leak in the threaded connection cannot be corrected while the unit is onstream.

Attachment through a gate valve, in conjunction with a retractable probe, usually permits correcting a leak unless the probe gets stuck. The survey showed that 65% of the refineries preferred a gate-valve entrance. Threaded fittings were preferred by 40% of the refineries, and flange connections by only 16%.

Attachment through a gate valve poses the secondary problem of specifying a satisfactory gate valve. The nominal valve size is 1 in.; however, some 1-in. valves have openings sufficiently restricted so that a retractable probe will not fit.

The standardization of probe lengths was favored by 40% of the refineries. Inasmuch as the probe specimen has to be located in a certain position with respect to the wall, and frequently a layer of insulation surrounds the vessel or pipe, the practicability of standardizing lengths may be doubted. However, if the distance between the inner surface of the vessel and the outer end of the entrance port is standardized at some dimension sufficient for the vast majority of cases, standardization of probe lengths may be practical.

Another possibility is to design probes with adjustable lengths, or to devise ports with inserts to compensate for length differences. With retractable probes, which are in partial use in 60% of the refineries, standardization of probe lengths is not essential. However, because retractable probes are not yet universally acceptable, the need for standardized nonretractable probes remains.

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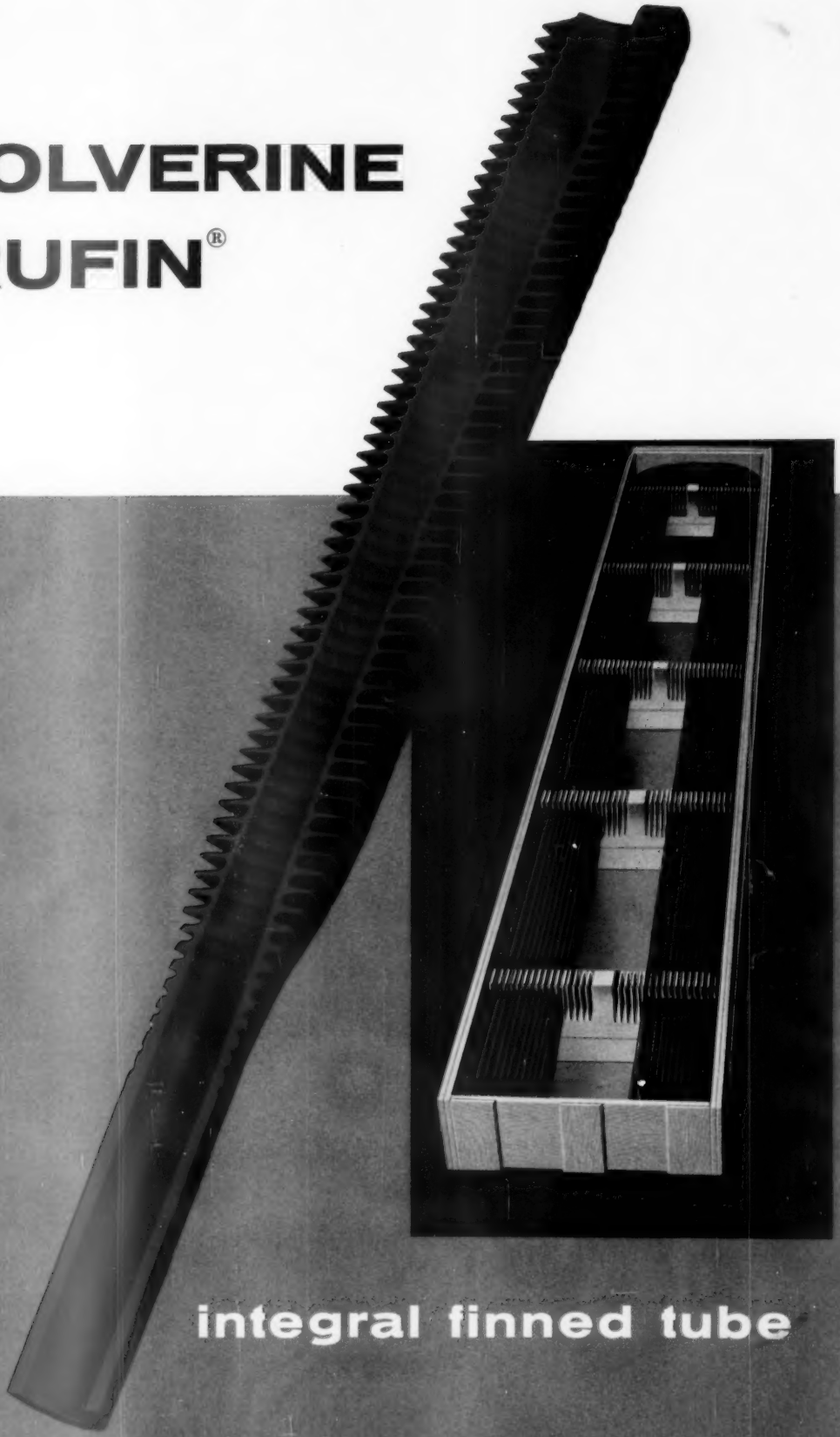

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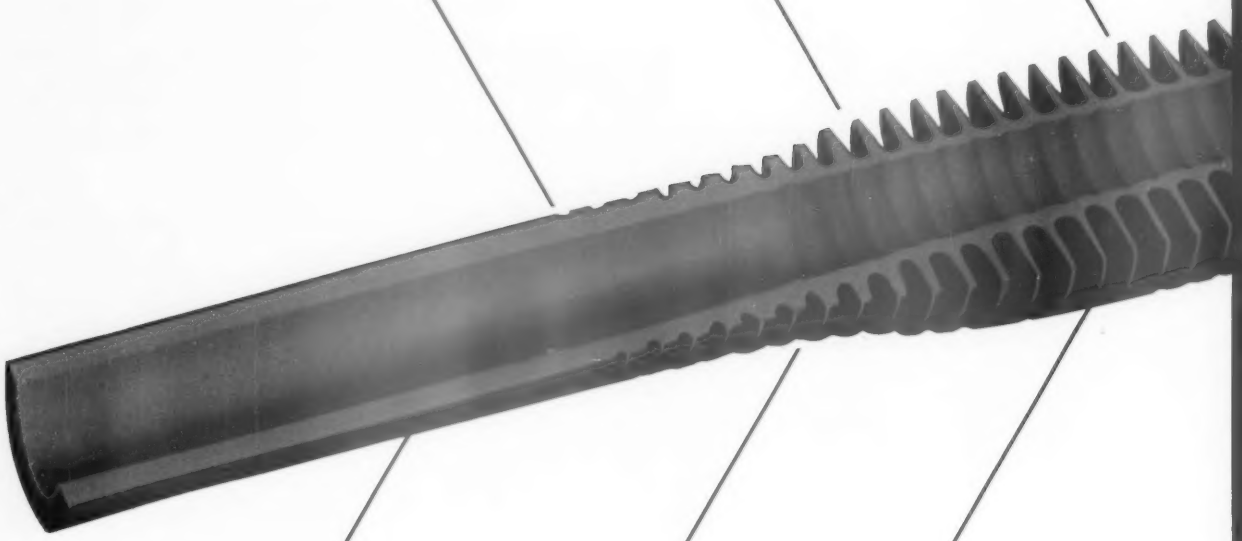

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Turnarounds needn't be dangerous

• Procedures which clearly point out hazards, equipment which is properly designed, and personnel who are well trained, insure safe shutdowns. Incorporate these ideas into written procedures for your unit.

BY A. H. HAYES AND R. M. MELAVEN
Standard Oil Co. (Indiana)
Whiting, Ind.

PRINCIPAL HAZARDS encountered in turnaround of units are accidental mixing of air and hydrocarbons, contacting liquid water with hot oil, and freezing of water.

Other hazards, encountered mostly during shutdowns, are corrosive and poisonous liquids and gases and pyrophoric iron sulfide.

1. What to do about shutdowns

The shutdown should include these seven consecutive phases:

- Cooling and depressuring the unit.
- Pumping out the unit.
- Removal of residual hydrocarbons.
- Removal of corrosive or poisonous materials.
- Disposal of water.
- Blinding and opening the unit.
- Removal of pyrophoric iron sulfide.

Adapted from paper presented at twenty-fifth midyear meeting of API's Division of Refining, Detroit, May 11, 1960.

Cooling and depressuring. First, external heat should be gradually reduced and finally cut off.

Next, the temperature of the material should be lowered to the point at which vaporization stops and which is below the incipient coking temperature. The decrease in vaporization soon renders overhead and sidestream systems inactive and permits them to be shut down. Reducing the temperature below the incipient coking temperature permits shutdown with a minimum of coking and fouling of equipment.

All fuel gas or oil to burners and all pilot burners should be shut off. Oil burners should be blown out with steam, leaving a small amount of steam blowing through the tips to keep them cool. Secondary-air dampers and flue-gas dampers to the stack should be opened wide to permit maximum flow of cool outside air through the furnace firebox.

Simultaneously, charge to the unit is reduced 70 to 75%, or to about the capacity of the bottoms pumps. After vaporization stops, these pumps must handle all of the oil to be circulated in the unit.

During this time, any operations needed to separate one material from another should be continued until the materials are segregated, i.e., propane and lubricating oil in a dewaxing plant or acid and oil in an alkylation plant.

Next, charge to unit should be shut off and internal circulation of oil in unit should be started. Oil should pass from charge pump through main components of unit—exchangers, furnace, towers, etc.—to bottoms pumps and back to suction of charge pump.

Coolers in circuit should be kept in operation. Circulation should continue until oil reaches "no vaporization—no cracking" temperature.

For units normally operating above atmospheric pressure, atmospheric pressure should be approached as temperature drops. Excess pressure should

be relieved by releasing hydrocarbon gases to a gas-collecting system.

If cooling tends to produce a vacuum, an inert gas should be introduced to maintain pressure close to atmospheric. An inert gas prevents fires or explosions. Air must not be introduced.

When cooling is essentially completed in a vacuum unit, vacuum should be broken by shutting off vacuum-producing equipment and gradually admitting an inert gas until atmospheric pressure is reached.

Whenever possible, dry steam should be used as the inert gas because, in addition to providing an inert atmosphere, it cleans equipment better than other inert gases.

Pumping out the unit. When the oil has been cooled to the required temperature, the oil and any other liquid which may have been separated from it in the unit, such as acids, caustic, and sludges, should be pumped from unit.

Each material, depending upon its character, should be pumped to a prescribed place. Centrifugal pumps should be watched carefully to make certain that none completely loses suction before it is shut down. Running a centrifugal pump dry for even a short time may seriously damage it.

If available, reciprocating pumps are best for pumpout because they have superior suction characteristics and are less susceptible to damage.

As oil is pumped from unit, it should be further cooled in heat-exchange equipment to a temperature where it will not cause flashing of water in delivery lines or tanks and to a temperature below its flash point so it will not cause a fire hazard in delivery tanks.

Inert gas should be admitted to unit continuously during pumpout for two reasons: to prevent entrance of air into the unit; and to keep internal pressure of unit close to atmospheric.

Removable of residual hydrocarbons. Removal of this material can be done in three major ways: displacement with an inert gas, water flooding to overflowing, and a combination of these two methods. Type of unit determines appropriate purging material.

... Steam should be used as the inert gas unless it would damage equipment or material in the unit, such as a catalyst. Distillation and coking units are typical units in which steam should be used.

In certain catalytic units in which steam would damage the catalyst, nitrogen, carbon dioxide, or gas from an inert-gas generator should be used.

When a gas is used for purging, it is commonly admitted at or near inlet to unit. Gas should flow from one vessel to another in succession from inlet to outlet of unit, including blowdown system, if unit has one.

This reduces chance of bypassing any area and gives an orderly procedure. If parallel paths of flow exist, care must be taken to insure that each path is purged.

Purge gas should continue to flow into and through every part of the unit until analytical tests show that the only material flowing from each drain and vent on the unit is purge gas.

Except where steam is being used, each vent and drain on unit should be closed as soon as test shows that nothing but purge gas is issuing. This will conserve gas and minimize purging time.

If steam is being used, all drains and vents at highest points of unit should be left open until tests show that only steam or water, or both, is issuing.

This step insures continuous drainage of all condensate as it forms, prevents trapping of liquid hydrocarbons on top of water pockets, and prevents any air from flowing into unit during purging. When purge is complete, purge gas should be replaced by air.

In vacuum units, residual hydrocarbons should be removed by a series of evacuations; each evacuation should be followed by filling unit with nitrogen or gas from an inert-gas generator.

These evacuations should be repeated until hydrocarbon content of gas in unit is not more than 0.5% but preferably 0.0%. Inert gas should then be replaced by air.

... Water filling of equipment to overflowing is an effective way to purge equipment. It displaces both gas and liquids, which otherwise might be trapped, and it cools the unit, if this is necessary.

It can be used only if the equipment and its foundation have been designed to support the weight and pressure of the water and only if water will do no damage.

In some units and equipment, water can be used by itself. In others, it should follow the steam purge. When this is done, vents should be open to admit air to the unit to prevent a vacuum which otherwise would form when cold water condensed the steam.

Water filling may be done either by flowing the water from one vessel to another until the entire system is overflowing or by filling several parts simultaneously until the system is full.

As water enters the unit, materials displaced should be vented from a high point of each part of unit to prevent trapping any oil, gas, or other material.

After water filling, water is drained to the sewer with enough atmospheric vents open so that air displaces the water as fast as it flows from unit. Sufficient air must enter unit to prevent pulling too much vacuum and to permit entry by maintenance personnel.

Corrosive or poisonous materials. Any residual amounts of corrosive or poisonous materials—such as acids, caustics, salts, and sludges—present in parts of certain units must be removed.

Purging material and procedure depend upon type of residual material. In our experience, water is used most frequently, followed by steam and water. Nitrogen is used the least. Procedure should be about the same as for removal of residual amounts of hydrocarbons.

Incomplete removal of corrosive or poisonous materials could present great hazards to both maintenance and operating personnel when the unit is opened for repairs and cleaning. Such gases as hydrogen sulfide, arsine, and hydrogen fluoride have high-potency hazards. Complete purging of such materials from units is imperative.

Disposal of water. Water remaining in the unit must be disposed of to prevent damage during downtime and startup. If water freezes inside the equipment, it can cause great damage and plug equipment.

Water should be drained from all low-point drains during shutdown. All drains should be checked for plugging. All plugged drains should be opened.

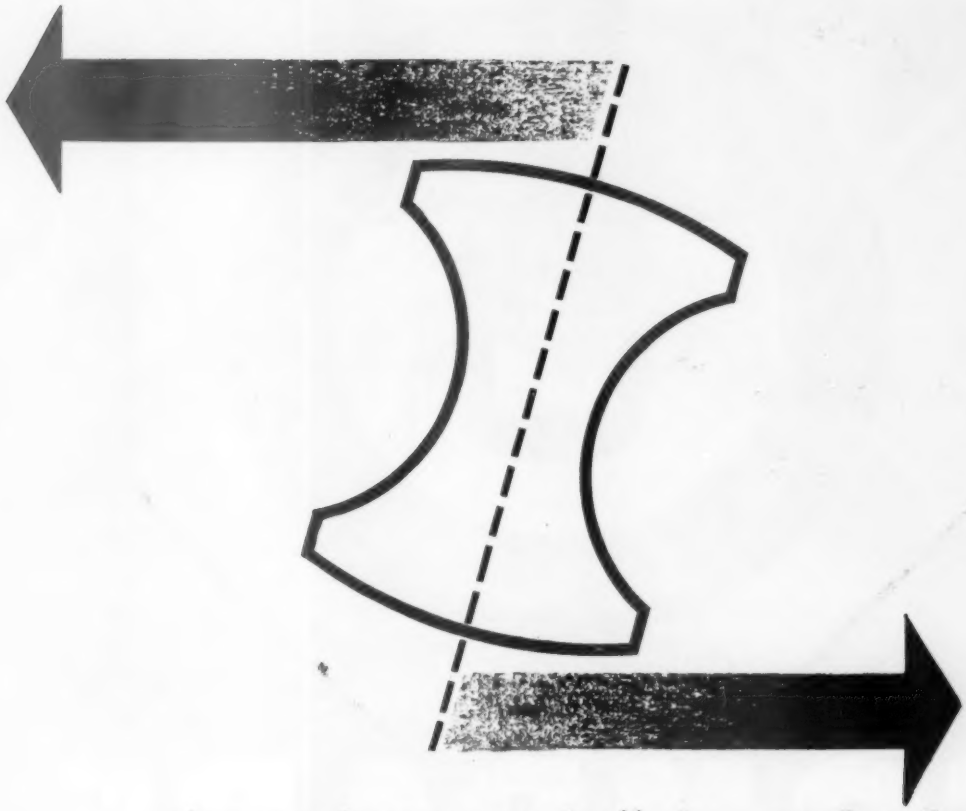
When part or all of the water and steam systems do not have to be shut down for cleaning or repairs, keeping the water and steam flowing at a sufficient rate prevents freezing in normal cooling and heating systems.

At other times, heat tracing and insulating of a system may be required. Antifreeze solutions may be used temporarily in some equipment, such as sewer traps or compressor jackets.

Blinding and Opening. Shutdown blinds should be installed in the various lines which leave and enter the unit to prevent any unwanted material from entering unit while it is down.

All connections to any tower or vessel, which men are to enter during the shutdown, should be blinded to prevent accidental entry of foreign material which might injure the men.

Opening lines to install blinds



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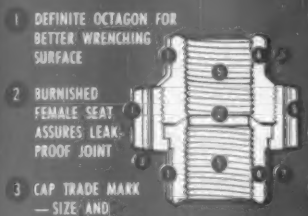

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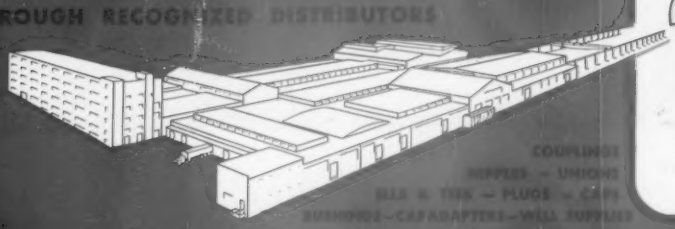

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should be done with extreme care. Flanges should be cracked open slowly so that any material incompletely purged from the unit can be handled safely.

Valves should not be removed until it is absolutely certain that the equipment to which the valves are attached is empty.

A list should be made of all blinds to be installed during the shutdown. The date on which each blind is installed and the initials of the operator who witnessed its installation should be noted on the list. A portion of a blind list is shown in Fig. 1.

Certain lines, vents, drains, etc. should be blinded at all times that the units are running. These running blinds should be removed at prescribed times during the shutdown to permit purging and draining of material from unit.

A list of these blinds should be made, and the date of removal of each blind and the initials of the operator who witnessed its removal should be noted on the list.

When the prescribed blinds are installed, the unit should be opened for repairs or cleaning.

Removal of iron sulfide. If pyrophoric iron sulfide is suspected or known to be present, men should stand by with water hoses to wet the sulfide down when the unit is opened.

To prevent the sulfide from igniting, a light oil, such as mineral seal oil, is better than water because it wets the sulfide more thoroughly and it evaporates more slowly. For this reason, oil may be used instead of water unless it creates an additional fire hazard.

The wet material should be completely removed mechanically, hauled a safe distance away, and allowed to burn.

Safety precautions. No one should enter any vessel, tower, etc. until gas tests and inspection show that equipment is free from all hazardous materials and that the air supply is good. If tests show the need for more purging, washing, or air ventilation, any or all of these things should be done.

All emergency equipment should be tested while the unit is being shut down so any malfunction can be corrected during downtime.

2. What to do about startups

The startup procedure should include these six phases:

- Preliminary preparations.
- Elimination of air.

End Run No. 5

Blind No.	Blind Location	In Date	In Initial	Out Date	Out Initial
	(Battery Limits Blinds)				
1	75# Fuel Gas	6/27	A.D.	10/21	J.M.
2	Synthesis gas to Ammonia Plant	6/27	A.D.	10/20	TC
3	40# make-gas out	6/27	A.D.	10/20	TC
4	25# Refinery fuel gas in	6/27	A.D.	10/20	TC
5	25# FLARE HDR Heavy naphtha product	7-4-7 6/28	J.V.	10/20	TC
6	Light naphtha product	6/28	J.V.	10/21/59	A.D.
7	Slop line	7-3-59	J.V.	10/21/59	A.D.
8	Ultraformate product	6/28	J.V.	10/21/59	A.D.
9	C_3-C_4 product	6/28	A.D.	10/21/59	A.D.
10	HIPSCO gas	6/27	A.D.	6-9	L.C.
11	Purge to flare				CK OUT
12	Wet gas	6/28	A.D.	10-21-59	A.D.
13	Naphtha Charge at G-1 & G-1A	6/28	A.D.	10-21-59	A.D.
14	D23 Vent on C_2	7/	J.V.		
15	D-13 2 Blinds	7/2	J.B.		OUT OK
16	D-9 —	7-3-59			
17	FUEL OIL	7-3-59			
18	SUPPLY & RETURN				
19	F-3, OUTLET BLINDED AT CLEAN VALVE, 7-3-59				
	D-1 INLET BLINDED BETWEEN F-1 VALVE & HAND VALVE B-1				

BLIND LIST, showing date of installation and removal of blinds, and initials of witness. Fig. 1.

- Tightness testing.
- Disposal of purge material.
- Elimination of water.
- Bringing unit onstream.

Preliminary preparations. Preliminary preparations for startup of a unit should include: (1) inspection of inside and outside to make sure that all parts are ready for startup; (2) activation of auxiliary equipment, such as utility systems, instrument systems, and gland-oil system; and (3) removal of shutdown blinds and installation of running blinds. The order in which these steps are carried out would depend upon the unit.

Usually, hazards exist or are created only when steam, water, fuel gas, and fuel-oil systems are activated and when blinds are removed and installed.

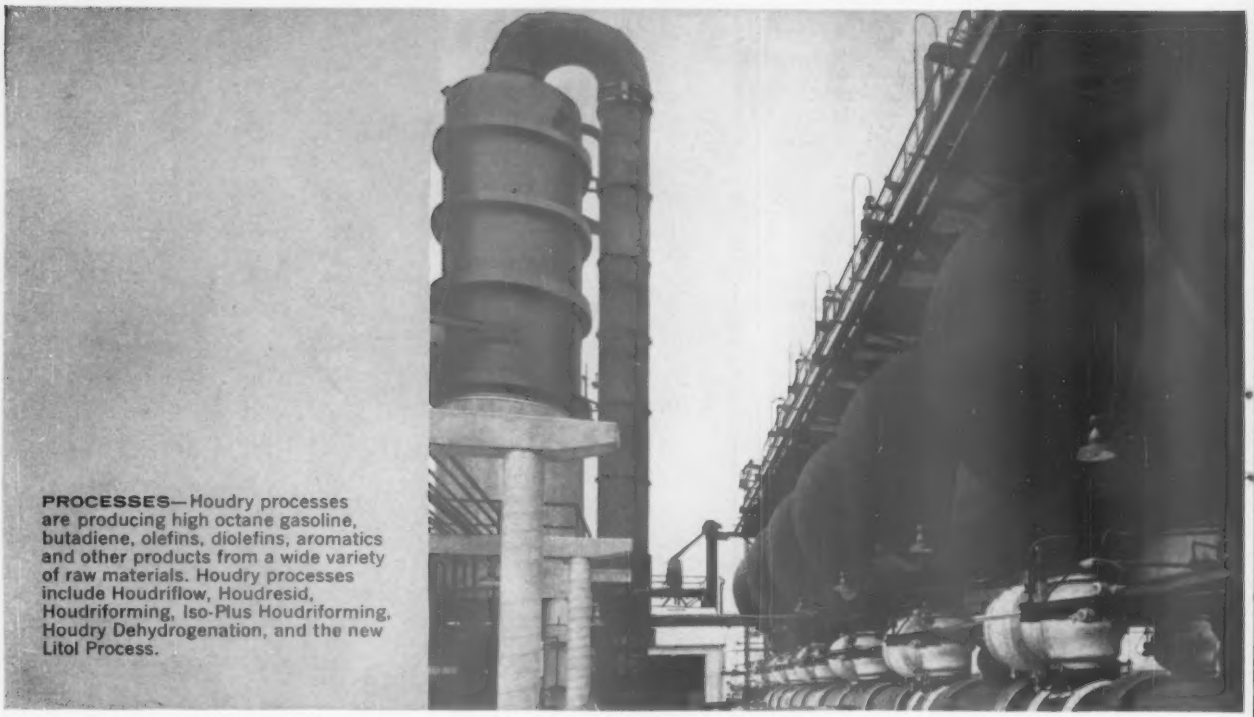
In activation of the steam systems, possible hazards are thermal and mechanical shock, overpressuring of steam turbine casings, introducing water into vessels where it is not wanted, and freezing of water in the systems.

To avoid these hazards, the systems should be activated by closing all steam block valves at vessels, towers, and steam turbines (except on the exhaust steam side); opening all bleeders and vents; and then slowly opening the main-line block valves to allow the systems to warm up slowly and to drain the condensate as rapidly as it forms.

When the temperatures are as high as they will get with free blow, the drains and vents should be closed and the steam traps should be put into service. Freezing should be prevented by making sure that no condensate is trapped in dead ends or in plugged or inoperable traps.

Hazards associated with activation of the water system are entry of water into places where it is not wanted and freezing of the water. To prevent the former, water connections used for purging or washings during the shutdown, or otherwise not needed for startup or normal operations, should be blinded.

The hazard of mixing air and hydrocarbons should be avoided in the activation of the fuel-gas and fuel-oil



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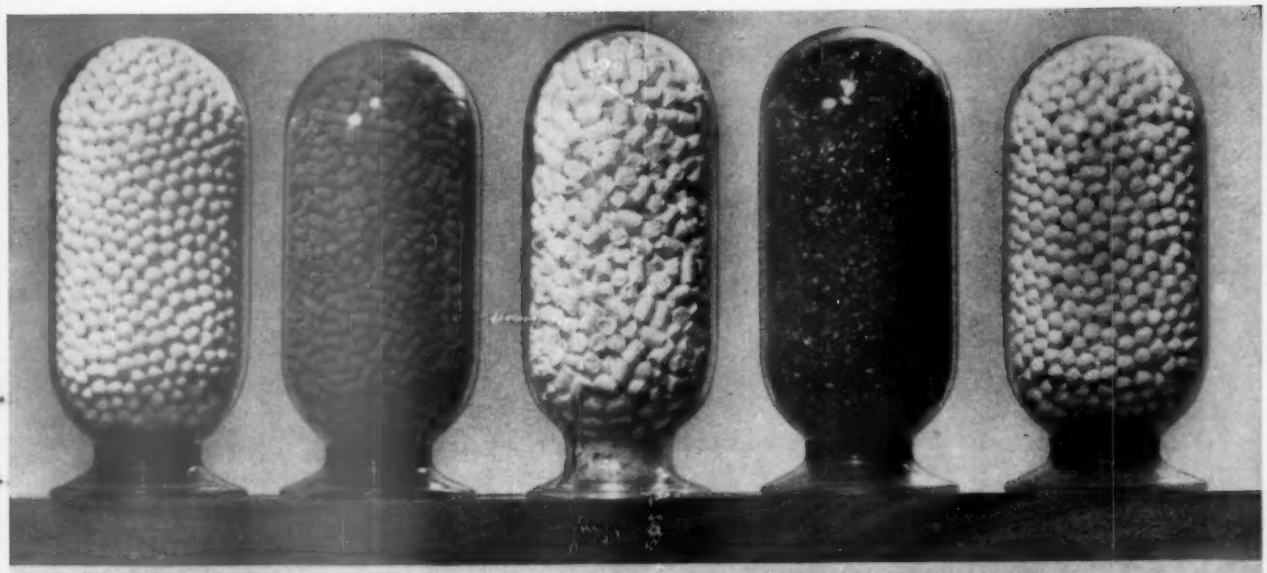

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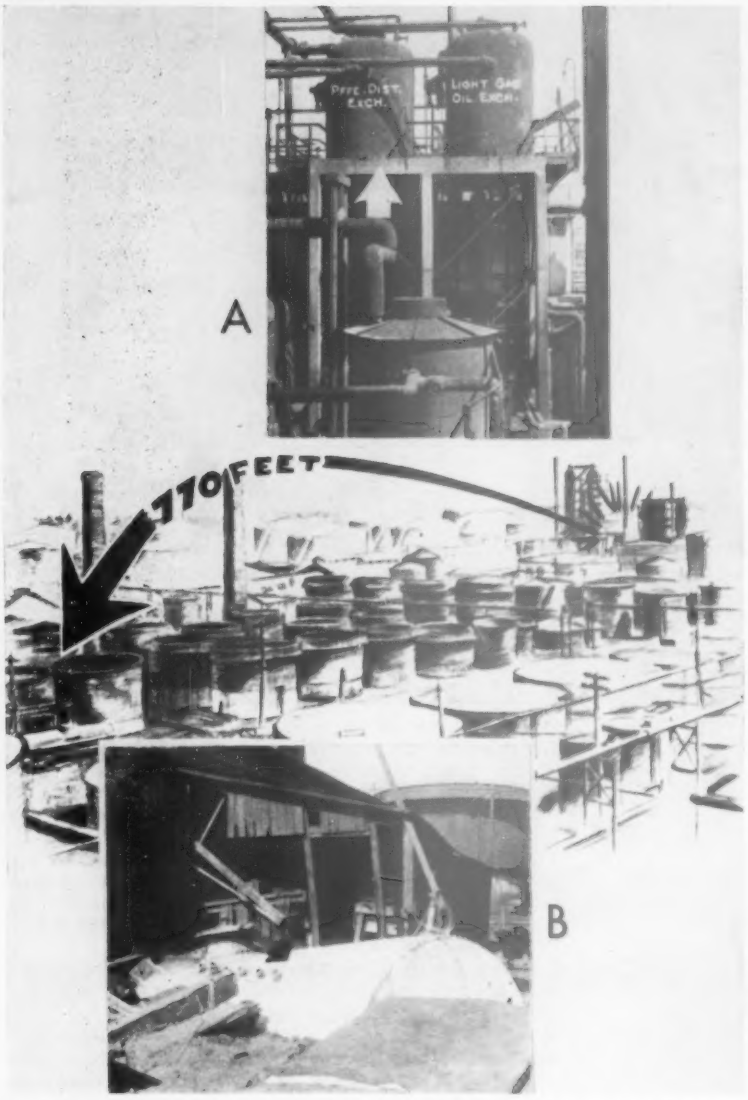

VIOLENT EXPLOSION which occurred when hot oil was introduced into (A) exchanger containing pool of water left wreckage shown at (B). A 7,000-lb. shell was blown 770 ft. and buried in the ground. Fig. 2.

systems. To do this, the air first should be purged from the systems with an inert gas, followed by displacement of the inert gas with the fuel gas or oil.

Improper removal of shutdown blinds and improper installation of running blinds could cause serious upsets and damage. First, materials which must later flow in the unit could be blocked. Second, materials which must be kept out of the system could flow into it. Also, much time would be wasted in the startup if an improperly removed or installed blind were found and the condition had to be corrected later.

To eliminate such difficulties, the list of blinds installed during the shutdown should be thoroughly checked. Each blind installed should be removed, and date of removal and initials of operator witnessing removal should be entered on the blind list. A list of running blinds and point in startup program when they should be installed should be prescribed in the startup procedure. Date of installation of each running blind and initials of witnessing operator should be noted on list.

Elimination of air. Eliminating air from any unit before hydrocarbons are introduced is generally the most important phase to insure safe startups. An example of what can happen if this is not done is shown in the photo at the start of this article. The air should be purged from the unit with an inert gas or liquid.

The choice of purge material depends upon the materials used in construction of the unit, the process, and cost of purge material. Steam and water are most commonly used. Where water would have a damaging effect, gas from an inert-gas generator, nitrogen, or carbon dioxide should be used. In some units, the catalyst section could be purged with nitrogen, and the fractionation section could be purged with steam or water, or both.

Purge material and procedure for its use should be prescribed in startup intsructions. Air should be purged from unit in the same manner previously described to purge hydrocarbons from unit during the shutdown.

The purge should be continued unitil tests by Orsat, or other oxygen-analysis equipment, show that the oxygen content throughout the unit is less than 0.5% by volume but preferably 0.0% by volume. Special equipment is available and should be used to test for oxygen in the presence of steam.

Steam, where it can be used, should be the purge material. In addition to removing air from the unit, it heats the equipment sufficiently to melt ice which accumulated during cold weather, it evaporates water from the system, and it reveals plugs in drains and vents more effectively than the other purge materials.

However, when steam is used, instrument taps, except pressure-gage taps, have to be closed to prevent steam from entering instrument lines. With neoprene or buna-N pump seals, steam must be bypassed around the pumps to prevent damage to the seal material.

Where check valves would prevent flow of purge material, bypasses would have to be opened around valves to permit required flow.

Where relief valves discharge into a closed system, such as a blowdown or flare system, the entire system from the downstream side of each valve through the blowdown or flare system would have to be purged. This could require special purge connections immediately downstream from the valves.

Subsequently, this closed system should be kept filled either with a purge gas or with a hydrocarbon gas, such as fuel gas, under slight pressure to keep all air out. A fire or explosion could result if hot oil or hydrocarbon gas should enter the system as a result of a subsequent relief-valve discharge.

With stream, the flow generally should be from the lower to the higher points of the unit. This not

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only is because steam is lighter than air and thus tends to rise in the unit, but it effects a refluxing, cleaning, and permeating action which would not be obtained by reversing the procedure.

With nitrogen or gas from an inert-gas generator, pressure during purging should be held as low as possible to minimize the quantity required of these relatively expensive materials.

Quality of the gas from an inert gas generator must be carefully maintained. A gas having 0.0% oxygen content purges equipment most quickly; gas of 1.0% oxygen content never would purge it. Also, the combustible content of the gas must be maintained at less than 1% to insure against danger of combustion, regardless of oxygen concentration which might be encountered in any part of the unit.

To free vacuum units of air, two or three evacuations are made; after each evacuation the system is repressured with inert gas or nitrogen. These evacuations should be continued until oxygen content has been reduced to the safe level.

All analytical tests performed during purging should be recorded. The log should show point tested, time of test, oxygen content, and initials of man making test. Critical check points—vents, drains, and the like—to be tested should be prescribed in advance as a part of the startup procedure.

Tightness testing. A unit to be started up or operated safely must be free from leaks through which hydrocarbons could leak out or air could leak in. Tightness testing and repair of leaks are required to insure a leak-free unit. The proper tests, pressure or vacuum, or both, depend upon the particular unit. Tests must be continued until all leaks are stopped.

In both pressure and vacuum tests, great care must be taken to subject equipment only to pressures or vacuums for which it is designed. Overpressuring can cause damage by bursting the equipment, underpressuring by collapsing the equipment. This applies to equipment of all sizes, from pressure gages to complete towers and vessels.

In the pressure test, the pressure of purge material in the unit should be raised to approximately 50 psig. or to within 10 psig. of the lowest relief-valve setting in the system, whichever is the lowest. At the end of the purge, all open vents are closed and more purge gas is admitted or added pressure is applied to the water by a pump until the required pressure has been reached.

At this pressure, every manway, flange, and joint on the unit should be inspected for leakage. Usually the sound of escaping gas, the appearance of steam fog, a flow of water, or the bubbling of applied soap solution indicates a leak.

After the test, pressure in the unit should be reduced to 1 to 2 psig. by opening a few high-point vents. A small flow of steam or water should be continued through these vents to insure that no air gets into the unit. Also, with steam, low-point drains should be opened periodically to drain the condensate. With nitrogen or inert gas from a generator, all drains and vents should be closed to hold this pressure.

A vacuum test should follow the pressure test for a unit that is to operate under vacuum. This test helps to reveal leaks, removes most of the water from the system, and prepares the system for the charging of oil.

While purge gas is flowing from the open vents at a few psi. pressure, following the pressure test for tightness, the parts of the unit which are to operate under vacuum should be isolated from the rest of the system by closing the appropriate valves. All low-point drains should be opened to drain off all possible condensate, then closed and plugged or blinded to prevent entrance of air at these points. The vents should be closed and plugged or blinded.

This should be followed by starting up the vacuum-generating equipment. As the vacuum increases, the purge gas should be throttled slowly until it is cut off entirely. The maximum vacuum possible should be established on the unit. The vacuum-generating equipment then should be shut off. No drop in vacuum within an hour indicates that the unit is tight and ready for startup.

A loss of vacuum indicates leaks or continued vaporization of water in the system. The leaks should be located and repaired. Should it be necessary to break any flanged joints, the vacuum on the system first should be released by slowly admitting purge gas to the system until a positive pressure of 1 to 2 psig. is obtained, to prevent inleakage of air.

If the vacuum equipment has been purged and tested for tightness with water, the vacuum test should be preceded by displacement with an inert gas of as much of the water as possible.

Disposal of purge material. For equipment to be operated at atmospheric pressures, or higher, the next phase should be to replace the purge material with fuel gas. Fuel gas should be used because it is readily available, it can be displaced back into the fuel gas stream as the unit is brought up, and it is essentially hydrocarbon material and thus compatible with material to be processed on the unit.

When steam has been used as purge material, stoppage of flow would result in cooling and condensation which would create a vacuum in the unit if all openings thereto were closed, or result in pulling air into the unit if it was not closed tight. To avoid these conditions, the purge steam must be replaced by a noncondensable gas pressured to higher than atmospheric pressure to prevent inleakage of air.

Likewise, fuel gas should be used to replace water from a unit that has been purged with water.

For units purged with inert gas or nitrogen, less of these materials is necessary if the unit is pressured with fuel gas rather than with purge gas. The mixture of gases can be displaced later into the refinery fuel gas system without causing trouble in the system or in the refinery.

Fuel gas should flow into the unit until pressure reaches either the normal fuel-gas line pressure or the highest pressure below this point which the unit can safely withstand. If the unit could withstand line pressure, it should be left floating on the line; if not, it should be left with the gas bottled up inside or be left floating on the line at a controlled lower pressure.

How purge material is replaced with fuel gas depends upon the purge and tightness test material used. If water has been used, the fuel gas is admitted at the high point of the water-filled system and the water is displaced to the sewer. To prevent air from leaking in, any vents left open for water overflow after the tightness test should be closed just before fuel gas is introduced.

Gas should be admitted until water stops flowing and gas issues from each low-point drain in the system; then closing each drain eliminates fire hazards created by gas flowing to the atmosphere. With all drains closed, fuel gas should flow into the system until proper pressure has been established.

In a system purged with inert gas or nitrogen, the fuel gas should be admitted directly into the unit and allowed to mix with the purge gas. Fuel gas should be admitted until proper pressure has been reached.

Where steam has been used as purge gas, the fuel gas should be admitted

to the unit by gradually opening the valve on the fuel gas line until it is wide open. Simultaneously, the steam to the unit should be throttled gradually until it is shut off.

As the gas enters the unit, the vents remaining open should be checked and closed in sufficient time to prevent the release of gas into the area. Opening low-point drains eliminates condensate, but they must be closed when gas flows out of them.

When all drains and vents are closed, the unit should be pressured to the desired pressure. All drains which are to be opened and checked should be prescribed in the startup procedure. The drain check should be recorded showing time of check, absence of condensate, and initials of the operator who made the check.

In vacuum units, it is not necessary to introduce fuel gas following purging and tightness testing. The purge gas should be disposed of by evacuation.

Elimination of water. Eliminating residual water before hot oil is introduced is generally the second most important phase to insure safe startups. Fig. 2 shows the consequence of a failure to recognize this point.

Residual water is eliminated from the unit by first circulating cold oil through the system, and then circulating warm to hot oil. Generally, the oil normally charged to the unit should be used. However, a low-pour-point gas oil of approximately 35° to 40° API gravity and 120° to 135° F. flash point could be used.

During cold-oil circulation, the oil temperature should be between 50° and 100° F.; during warm-oil circulation, between 100° and 180° F.; and during hot-oil circulation, between 180° and 350° F. or higher. Hot-oil circulation is used principally for units having normal operating temperatures which are higher than the boiling point of water.

Cold oil is pumped through an unfired unit by following the normal oil flow pattern and by using as many pumps, including the feed pump, as are needed. When the oil has completed the circuit, it should be returned to the suction of the feed pump for recirculation through the unit. Water in the system should be swept to the low points of the unit.

As many instruments as possible should be placed in service at this time. They should be checked out as completely as possible so they can be relied on to correctly indicate the condition of the unit as startup progresses.

During circulation, each low-point drain in the unit should be opened and drained until no water issues from the drain. To facilitate water drainage, circulation should be stopped after 30 or 40 minutes to allow any water-oil emulsion, or mixture, to break and allow the water to settle into the low-point drain sections of the unit. The circulation then should be resumed and continued until nothing but oil appears at each drain. Any plugged drain should be opened.

The pressure of the fuel gas in the unit should prevent air from entering the unit through the drains during the water-removal operation.

When no more water is draining, steam-heated exchangers, or other equipment, should be used to raise the temperature of the circulating oil to approximately 180° F. within 2 to 3 hours. This oil should rapidly melt any residual ice, help break any emulsions, and carry the water to the low-point drains.

For units whose normal operating temperatures do not exceed the boiling point of water, circulation of 180° F. oil until no water appears at the drains should complete the water-removal operation.

For units that operate at temperatures above the boiling point of water, the oil should be further heated. At this point, the oil flow commonly is changed from circulation to once-through operation. The off-test oil from the unit should be pumped to predesignated storage or process units. The oil charge rate should be approximately 25% of normal, or approximately the maximum capacity of the bottoms pumps.

Generally, higher temperature units have a fired heater which should be used to heat the oil. The heater should be fired, following strict firing instructions which should be given in the startup procedure to insure that this operation is done safely.[3]

The greatest hazard in lighting a furnace is the ignition of oil vapors or gas accumulated in the firebox. To avoid this hazard, the firebox must be purged with steam and air to remove all oil vapors and gas. The stack draft should be well established. The furnace should be started up on gas.

The operator should light the burner, or pilot flame if one is available, with a long-handled torch; he should stand to one side of the burner while doing this. Oil must be flowing through all passes of the heater before lighting the burners to prevent heat damage to the heater tubes.

Enough burners should be lighted to raise the fired heater, or furnace, outlet temperature approximately 100° F. per hour until 270° F. is reached. This temperature should be maintained for approximately 1 hour. At this temperature, the cooling effects in the system will be such that water will continue to exist in liquid form. Again, any accumulated water should be drained from all low-point drains.

The furnace outlet temperature then should be raised approximately 50° F. per hour. During this time, the entire unit should be heating up. Vaporization of the oil should take place at an increasing rate. Any residual water in the unit should vaporize and pass along with the vaporized oil to cooler parts of unit—such as reflux drums, product rundown lines, condensers, and coolers—and there appear again as liquid water together with condensed oil.

The water should be drained from low points of these cooler parts of unit so that it does not pass on to subsequent processing units and cause trouble.

Again, as many instruments as possible should be placed in service as soon as possible during these steps in the startup so they can be relied upon for correct indications as startup continues.

Reflux lines and manifolds should be flushed with the oil condensate in the system before the temperature at the point where the reflux enters the tower reaches 200° F. Both regular and spare pumps should be started up to flush out the suction and discharge lines with the condensed oil. Heat exchangers and condensers should be flushed out to slop, or back to tankage, depending upon operating procedures. Blowdown and emergency lines must be flushed.

The water which collects in reflux drums must be drained frequently to prevent it from being pumped back to a tower with the reflux. If not drained, it could violently upset the unit.

Continuing these operations for several hours should finally remove the last traces of liquid water in the system and prevent any damage that might have resulted from the contact of liquid water with hot oil.

Final removal of liquid water from the hot sections is indicated by steady suction at, and discharge from, the bottoms and product pumps.

At this point, the charge rate to the unit should be increased 5 to 10% of the normal rate per hour and the furnace outlet temperature should be raised approximately 100° F. per hour until normal operating conditions are reached.

The same procedure should be used to remove water from a vacuum

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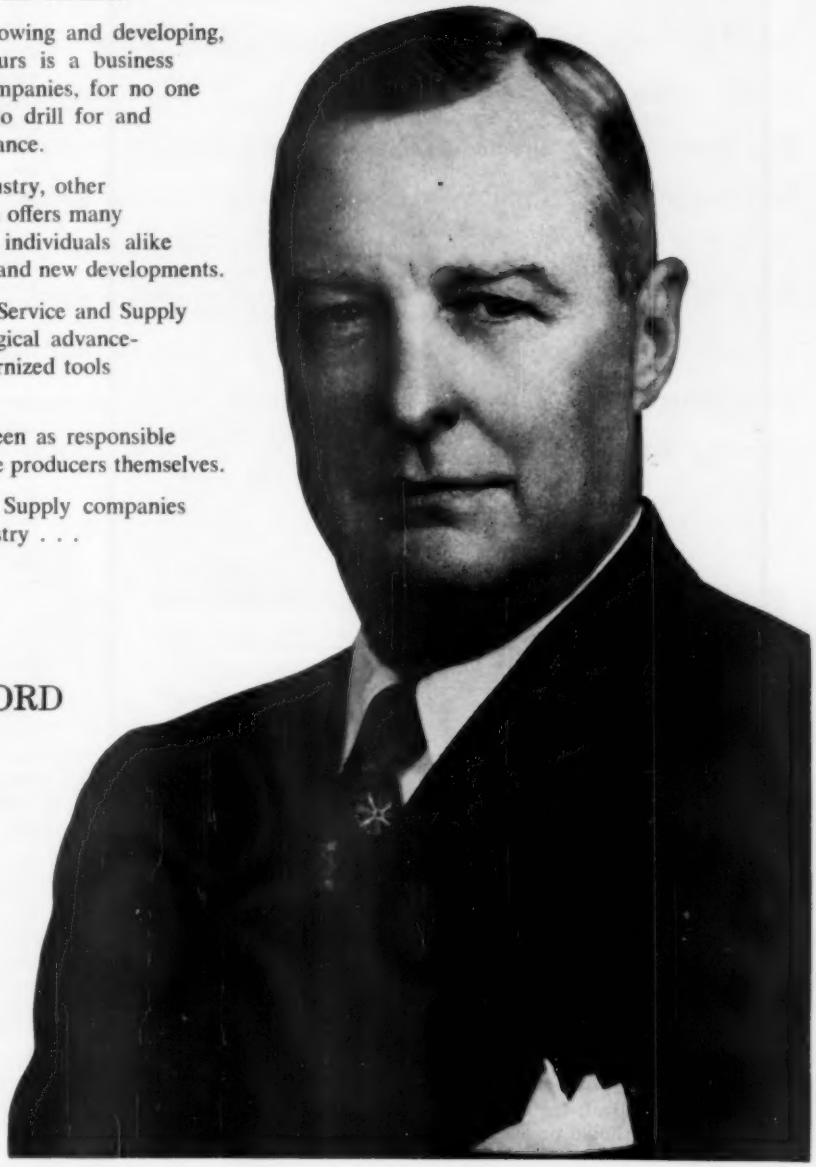
"For instance, the Manufacturing, Service and Supply companies have given us technological advancements, better equipment and modernized tools to drill for and produce oil.

"In truth, these companies have been as responsible for the success of our industry as the producers themselves.

"The Manufacturing, Service and Supply companies typify the freedom of the oil industry . . . our progress is evident."



MR. W. K. WHITEFORD

President and Chief
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Gulf Oil Corporation

P.E.S.A.*

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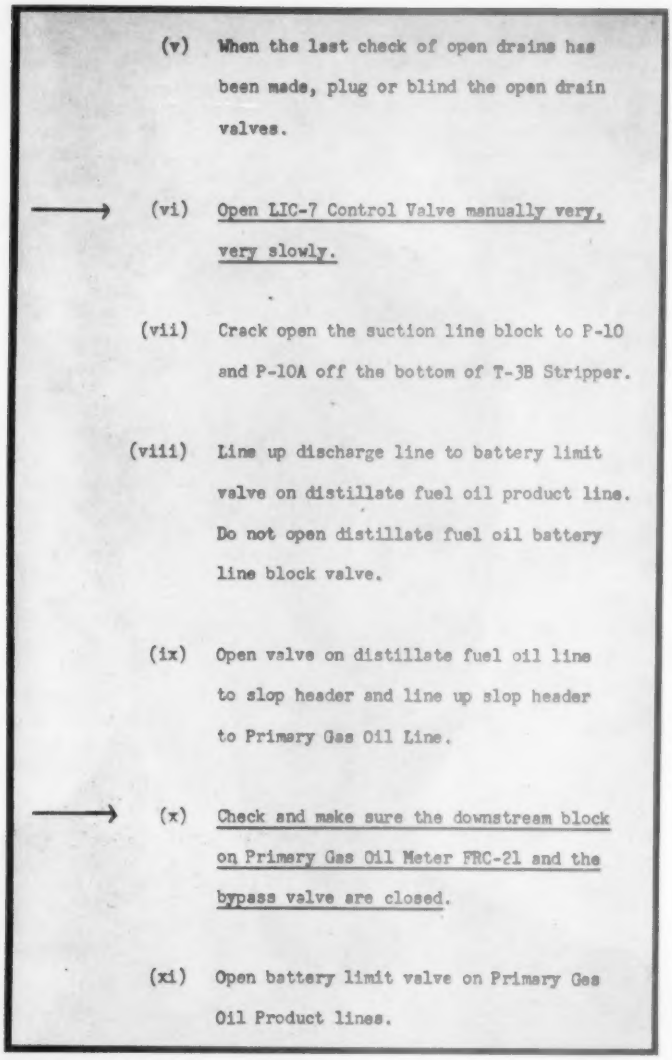
(v) When the last check of open drains has been made, plug or blind the open drain valves.
(vi) Open LIC-7 Control Valve manually very, very slowly.
(vii) Crack open the suction line block to P-10 and P-10A off the bottom of T-3B Stripper.
(viii) Line up discharge line to battery limit valve on distillate fuel oil product line. Do not open distillate fuel oil battery line block valve.
(ix) Open valve on distillate fuel oil line to slop header and line up slop header to Primary Gas Oil Line.
(x) Check and make sure the downstream block on Primary Gas Oil Meter FRC-21 and the bypass valve are closed.
(xi) Open battery limit valve on Primary Gas Oil Product lines.

IMPORTANT STEPS in "ups" and "downs" procedures are emphasized by arrows and underlinings. Fig. 3.

unit, even though the unit may be under normal operating vacuum and thus be relatively free of water. For a vacuum tower in which bottoms from a primary distillation tower are being further reduced, the water flushing could be done with a gas oil.

After water removal, the temperature of the gas oil should be increased until it is close to that of the primary tower bottoms product. At this point, the oil flow should be switched from the gas-oil circulation to the hot reduced crude oil from the primary tower bottoms. With this procedure, the switch would be made without danger of undue thermal or mechanical shocks.

Bringing unit onstream. Bringing the unit onstream primarily involves increasing temperatures and flows, adjusting pressures and controls, and routing of the various gas and liquid streams to prescribed destinations until the unit reaches prescribed normal operating conditions. These operations usually are accomplished without difficulty. However, depending upon the unit, certain hazards must be recognized and avoided to safely bring the unit onstream.

Major hazards which may be encountered are: water shots from feed tanks or lines, or from introduction of stripping stream; thermal and mechanical shocks which can result from too rapid a change in operating conditions, or failure to recognize the temperature interdependence of the several parts of the unit; danger of overpressuring; improper introduction of torch oil in a catalytic cracking unit; and danger of introducing air from one part of a unit where it is required to another part of the unit where it must be excluded.

To avoid the hazards of water shots, operators must be constantly alert to signs of water in incoming stock, such as a steady or sudden pressure rise in the unit, depending upon the amount of water. If this is noticed, feed to unit should be throttled until pressures drop to normal; the pumping station should be notified immediately and the situation should be corrected. Feed tanks and low places in delivery lines should be drained of water before deliveries are made.

Stripping and distillation steam should be introduced to the unit only after the steam line has been completely freed of condensate by a free blow to atmosphere and after it has been tested to insure that all steam traps are working properly.

Thermal and mechanical shocks should be avoided by recognizing the temperature and pressure differences in the various parts of the unit. Changes in temperatures, pressure, flow, and the like should be made slowly and uniformly enough to avoid shocks which could lead to undue physical strains on the equipment.

Overpressuring should be avoided by making sure that there is no improper blockage in outlet lines; also, that as the gas pressure in the unit rises, the gas is released to the refinery gas-collecting system at the proper time and under the proper backpressure control. It is at this time that the fuel gas admitted to the unit, prior to water removal, should be returned to the refinery gas system.

The improper use of torch oil in the startup of fluid catalytic cracking units can create a hazard. The oil is injected into the hot-air-filled regenerator to facilitate heating of the catalyst. If the oil is dispersed through the vessel before it ignites, an explosion or detonation can occur.

To avoid this hazard, the oil is not injected until: (1) the air in the regenerator is hot enough to absolutely insure immediate ignition and continued burning of the oil; and (2) the fluid catalyst bed level is at least 2 ft. above the injection nozzle.

In units such as fluid catalytic cracking units, air must be used in one part of the unit; however, to avoid fires and explosions, air must be kept out of the other parts of the unit. In these units, operations must be controlled so that air does not enter where it does not belong.

Write It Up

After safe procedures for the "ups"

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CASE HISTORY #1

Major Eastern Refinery

Use of the TOTCO End-Point Analyzer enabled this refiner to step up end-point specifications of reformer feed stock by 10°F with safety. Results: increased yield and a saving of over $200 a day. On the basis of this test, six additional Totco units were ordered!

CASE HISTORY #2

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Both TOTCO's End-Point Analyzer and Initial Boiling Point Analyzer were used here on a narrow-cut solvent. It was found that the analyzers kept yield on grade better than 99% of the time! Previous average with laboratory control was 90%.

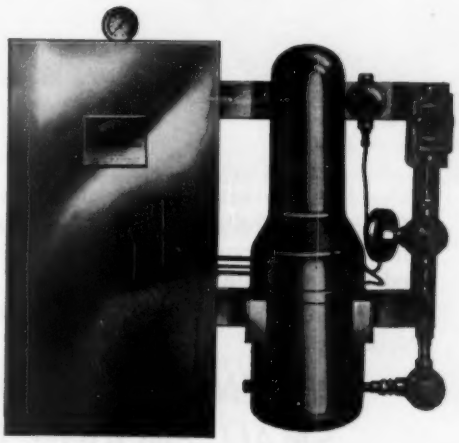
CASE HISTORY #3

Major Mid-West Refinery

In this test, the TOTCO End-Point Analyzer was mounted in a trailer and used on a crude still to control first-cut products on stream. So successful was the test that the company ordered two additional Analyzers for use at other refineries.

TOTCO CONTINUOUS INITIAL BOILING POINT ANALYZER

Totco also manufactures an Initial Boiling Point Analyzer. Write for Bulletin 1259-11 giving details and operating data.



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CASE HISTORY #4

Major Western Refinery

Demonstrating the versatility of the TOTCO End-Point Analyzer was this test where it was used to control the cut on heavy naptha. The test was a money-saving success, and the firm has since ordered additional units.

and "downs" of any unit have been developed, they should be incorporated into a detailed written procedure. The procedures should convey a clear and definite understanding of the steps to be followed.[4,5] All vagueness must be avoided.

The steps of the procedures should be presented in the exact sequence which will be used. The checkoff system should be used, reporting the exact condition of the unit at all times and initials of operators making the report. Emphasis should be placed on especially important safety and process steps. An effective way to convey this emphasis is shown in Fig. 4.

The proper activation of instruments must be emphasized so that reliable control and indications of operating conditions can be maintained at all times. No deviation from the procedure should be allowed, except on approval of the supervisor in charge of the unit. He should not approve any change unless he is sure that no hazard will result.

An experienced supervisor should be present on each shift during startup. Likewise, well-trained operators must be used.[6] They should be aware of their dependence upon instruments, and should recognize, investigate, and seek causes for any discrepancies. Finally, well-trained maintenance men and an expert instrument man should be present to correct equipment troubles and help put the instruments in service, as required.

Procedures which clearly point out potential hazards, equipment which is properly designed, and personnel who are well trained should insure safe shutdowns and startups. The petroleum industry has used both its failures and successes as stepping stones to achieve these operating conditions in progressively better measure. With the increasing variety and complexity of refining units, this type of activity will require continued and diligent study.

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7*

*7 — *that's the number of Nelson unit substations* originally installed in a single Illinois industrial plant. Just two years later, they added two more Nelson substations in an expansion program.**

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Feed stock is vaporized and mixed with hydrogen which catalytically reacts with sulphur contained in the feed stock mostly in the form of mercaptans, to form hydrogen sulphide which is further processed to recover elemental sulphur. After HYDROFINING the liquid product is washed with caustic and filtered through charcoal.

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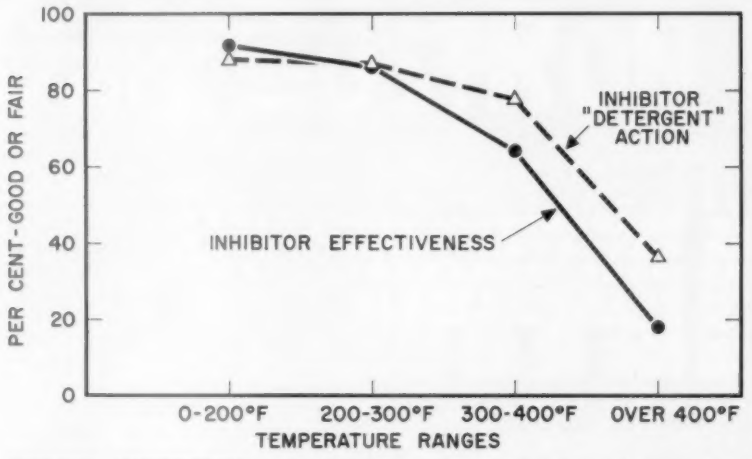
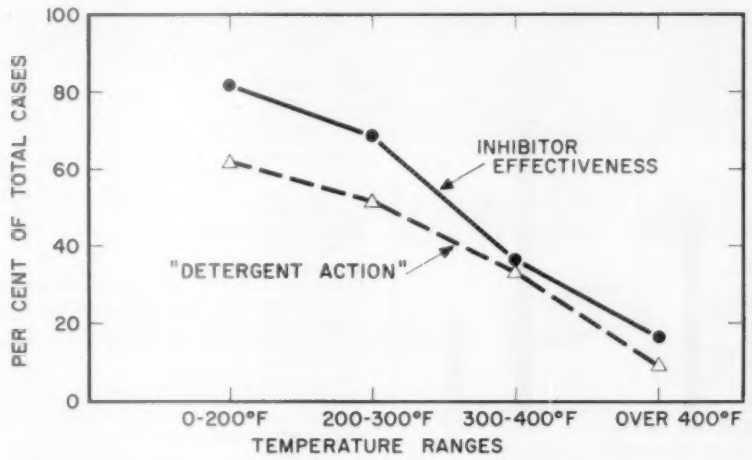


INHIBITOR EFFECTIVENESS and detergent action as function of temperature ranges. Fig. 1.



EXPERIENCES REPORTED in the various temperature ranges as per cent of total cases. Fig. 2.

What's the performance record of

Corrosion inhibitors in refinery process streams?

- An API survey shows that organic film-forming inhibitors are finding successful application in many refinery services. In general, temperatures above 400° F. and increasing concentrations of impurities in process streams reduce inhibitor effectiveness.

Adapted from paper by D. L. Burns, Gulf Oil Corp.; R. L. Hildebrand, Sinclair Refining Co.; and Paul D. Thomas, Asiatic Petroleum Corp. Presented at twenty-fifth midyear meeting, API Division of Refining, Detroit, May 9, 1960.

INHIBITORS in refining use are high-molecular-weight organic semipolar compounds containing nitrogen, sulfur, or phosphorus. The more common ones are amines, amine salts, and mixtures of these, compounded with suitable diluents or solvents. They are surface-active, as well as film forming.

Inhibitive action. The survey showed that many inhibitors produced "good" or "fair" results. It was assumed that a good or fair rating assigned to an inhibitor application indicated satisfactory results, and the inhibitor would be continued in use.

Those rated "poor" were considered unsatisfactory. A number were discontinued after testing, and it may be assumed that the remainder reported in the poor category would be used only until a more efficient inhibitor was found or other methods of corrosion control were developed.

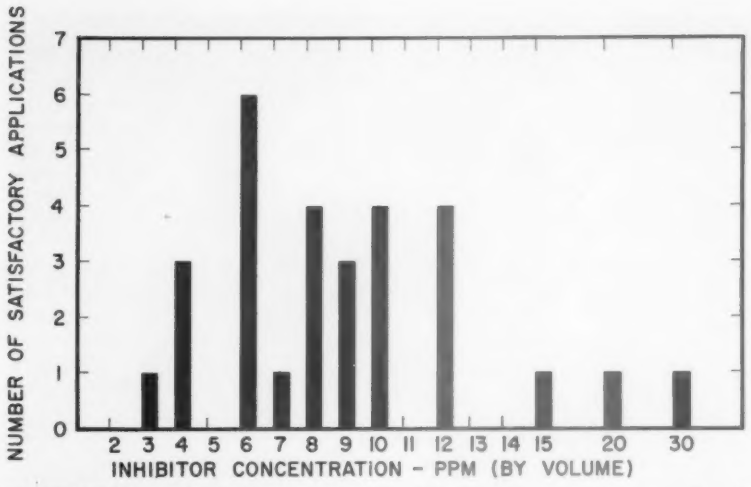
The percentages of applications wherein inhibitor performance was reported satisfactory were plotted versus service temperatures in Fig. 1. Each percentage was based only on the cases reported in the stated temperature ranges. It is apparent that the effectiveness of these inhibitors dropped sharply as service temperatures exceeded 300° F. For example, inhibitor applications were reported satisfactory in 91.2% of the cases in the 0° to 200° F. temperature ranges; 64.0% at 300° to 400° F.; but only 18.5% at 400° F. and higher.

Although temperatures of 400° and 450° F. have been mentioned as possible upper limits for effective application of organic corrosion inhibitors, there has been little evidence heretofore presented to substantiate this. The sharp drop in inhibitor effectiveness as temperature increased was not fully anticipated. It should be noted that the percentages in the upper temperature brackets were based on a relatively small number of applications, as indicated in Fig. 2, and any error in either reported or field control would result, thereby, in abnormal percentages.

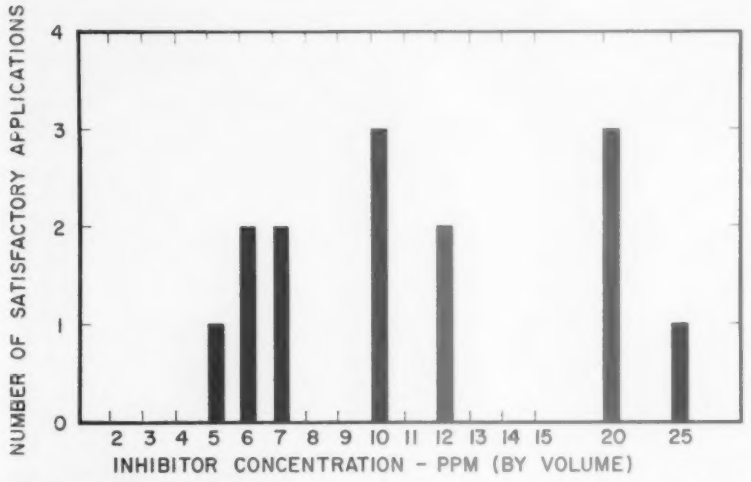
For example, there were only 27 out of the 167 cases, or 16%, reported at 400° F. and higher. The apparently low inhibitor efficiency in the higher-temperature applications could be the result of increased corrosion rates, accelerated desorption of inhibitor molecules, or changes in density of metal scale which would tend to prevent maintenance of inhibitor films.

Inhibitor concentrations or dosages at higher temperatures were not appreciably greater than those used at lower temperatures.

The general trend of results is clear,



SATISFACTORY APPLICATIONS at various inhibitor concentrations, crude-unit atmospheric tower overhead. Fig. 3.



SATISFACTORY APPLICATIONS at various inhibitor concentrations, crude-unit light-naphtha stream. Fig. 4.

however, indicating that applications of organic inhibitors in streams where temperatures approach 400° F. should be considered with caution. This is a factor to consider when evaluating new inhibitor applications versus alloy protection in the design of new units or in the substitution of materials in old units.

Detergent action. Detergent properties of inhibitors were considered inasmuch as they contribute to operating efficiency of process units while on stream. Clean metal surfaces also are related to corrosion control.

For example, experiments have shown that iron sulfide deposits are more noble than monel and type 304 stainless in certain environments, and thereby promote accelerated electrolytic corrosion, normally in the form of pitting. Detergent action of inhibitors would control this destructive metal deterioration.

The reported "detergent" effect, i.e., the ability to maintain clean surfaces, is believed to be the result of two processes: first, the inhibition of corrosion to such an extent that less corrosion product is formed; second, the actual detergent action caused by the surface-active properties of these inhibitors.

Most detergency results from a reduction in interfacial tension between entrained particles and metal surfaces, with subsequent loosening of scale, followed by dispersion and suspension of the scale in the stream.

Applications showing good or fair detergent action were also plotted versus service temperatures, as indicated by the dotted line in Fig. 1. The results followed a pattern similar to that for inhibitive action, exhibiting only slightly better performance in the higher-temperature brackets. Inhibitor dosages were comparable to those used for corrosion inhibition.

Other observations. Although data on stream contaminants did not permit quantitative correlation, several observations of a qualitative nature may be of interest:

Sulfur: Reported sulfur content of oil charged to crude-oil units ranged from 0.15 to 4.0% by weight. In 73% of those cases, sulfur content averaged more than 1%; in 93%, sulfur was higher than 0.35%. This emphasizes two points:

1. The omnipresence of sulfur.
2. Inhibitors are more widely applied in streams with relatively high-sulfur content.

Water: Water, with its attendant dis-

TABLE 1—PROCESS STREAMS AND SERVICES IN WHICH INHIBITORS WERE USED

Stream or service—	No. of cases	Per cent of total
No. 1 crude tower overhead	37	22.15
Light naphtha	17	10.18
Second fractionator overhead	1	0.60
Depentanizer	1	0.60
Depentanizer overhead	1	0.60
Debutanizers	4	2.40
Debutanizer overhead	9	5.38
Debutanizer reboilers	3	1.80
Vacuum-tower overhead	3	1.80
Vacuum-tower eductor	1	0.60
Vacuum-tower sidestream	1	0.60
Depropanizer	1	0.60
Depropanizer overhead	14	8.38
Stabilizer tower	1	0.60
Stabilizer overhead	8	4.78
Feed-preheat exchangers—reformers	4	2.40
Prefractionator overhead	10	5.99
Prefractionator bottoms	1	0.60
Reactor effluent	5	2.99
Reformate	3	1.80
Stripper overhead	1	0.60
Deethanizer reboiler	1	0.60
Gas streams	6	3.58
Absorber or absorber oil	8	4.78
Lean-oil still	1	0.60
Deisobutanizer	1	0.60
Regenerator overhead—amine units	3	1.80
Regenerator reboilers	1	0.60
Regenerator reflux	1	0.60
DEA solutions	6	3.59
MEA solution	1	0.60
Light alkylate—alkylation (H_2SO_4)	2	1.20
Alkylate rerun-tower overhead	1	0.60
Alkylate reactor effluent	1	0.60
Alkylate rerun twr. O.H.-alkylation (HF)	1	0.60
Tower bottoms—rerun unit	1	0.60
Rerun-tower overhead—trtd. distillate	1	0.60
Distillate-catalytic cracking unit	1	0.60
Extract mix—lube processing	3	1.80
Toluene dehydrogenation product	1	0.60
Totals	167	100.00

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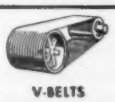
V-BELTS

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Facts-of-Life for successful engineers must include attitude, self-appraisal, vision, understanding, respect, relaxation and "happiness"

Achieving "success" and/or "happiness" in your professional and personal future won't just "happen," regardless of how diligently you apply yourself to your daily tasks, unless your efforts are coordinated along specific paths of endeavor. Your life as an engineer must be counterbalanced by your life as an individual — because "engineers ARE human," despite comment to the contrary.

The engineer reacts to the same human stimuli and motivations as the man in the accounting division, the sales department, the repair and maintenance crew, the general office force, or in the management division. All are motivated to varying extents by the same drives for recognition, self-respect, material progress, functional importance, personal pleasure, financial stability — and "security," however, the latter is translated.

The fact of the matter is no longer "theoretical," it is accepted, proven, practical "common-sense": to accomplish either or both of these achievements, your pursuit of "happiness" and/or "success" must have (a) ambition, (b) definition, (c) purpose, (d) direction. It is a life-long pursuit, subject to many detours and changes. In the pursuit itself, however, will be found much of its own reward.

One of our basic problems seems to stem from our relationships with *others* — our reactions to the drives of other people and their reactions to ours, because, like it or not, we *are* affected by other people, and they are affected by us.

Professionally, we are affected by our superiors, associates and subordinates — both technical and non-technical. Personally, we are affected by our family, our relatives and our friends — on and off the job. Our object then, is to ascribe to both our professional and personal life those qualities and human attributes which bring professional success and personal happiness. *We must develop a formula for living.*

This limited space, of course, does not permit a full look at this most complex of subjects, but a more complete treatment of human relations in engineering is found in a booklet entitled "Success and/or Happiness — in Engineering," available free upon request. Write for your copy to WESTERN SUPPLY COMPANY, HEAT EXCHANGER DIVISION, P. O. BOX 1888, TULSA, OKLA. — and remember, *our* success and happiness stems partially from the heat exchangers in *your* future.

solved salts, gases, and wide range of pH values, was reported present in more than 80% of the cases, ranging from 0.01 to 15.0% and averaging 1.35 wt. %. The use of steam in towers accounted for the higher water content in some streams. These figures do not include amine-treating units employing aqueous solutions wherein water was present at 64 to 90% concentration.

pH values: The pH values of effluent water from crude-oil-unit overhead receivers averaged 7.08, very near to the neutral point; the lowest reported was 3.5, the highest 9.0. The use of ammonia in crude-oil-tower overheads to neutralize acidic components has been common practice and is reflected in the pH control.

Chlorides as indicated by desalting: No direct data were obtained on chloride content of streams, but information was requested regarding desalting of crude oils charged.

Where inhibitors were used in crude-oil units charging desalted crude oil, there were only 4 applications out of 48, or 8.3%, which indicated poor inhibition compared to 4 applications out of 16, or 25%, reporting poor inhibition in cases involving undesalted crude oil. Inhibitor dosages for satisfactory results in crude-oil-distillation units averaged 9.0 p.p.m. in the cases of desalted crude oils versus 9.5 p.p.m. for the applications involving the undesalted crude oils, indicating that slightly higher quantities of inhibitors were required to obtain protection where crude oil was not desalted.

The use of ammonia to neutralize strong acids in the overhead streams of crude-oil units undoubtedly accounted for the fact that greater differences in inhibitor effectiveness were not noted between applications involving desalted versus undesalted crude oils.

Oxygen: The questionnaire did not cover information on oxygen in the streams, but three companies commented on this element, stating that two inhibitors tried were ineffective when oxygen was present. Additional sources have indicated that the effectiveness of other commercial inhibitors of the organic type declines in the presence of oxygen.

Hydrogen: Two refiners volunteered the opinion that inhibitors in fluid catalytic cracking units had helped to control hydrogen blistering, although proof of this was clouded by other changes made in processing operations at the time inhibitors were started.

Refinery streams: Forty streams or services were reported in which inhibitors were used. They are listed in Table 1. Approximately 64% of the applications were in overhead streams. It appeared that information on some services, particularly those at higher temperatures, was given as a result of inhibitors being injected to protect equipment upstream.

For example, a portion of an inhibitor injected into an overhead stream generally is carried back into the tower with the reflux, and may provide some protection to the tower or reboiler which operates at higher temperatures than those in the overhead system.

Injection rates: The concentrations at which inhibitors were used in streams where satisfactory results were obtained averaged 9.9 p.p.m. by volume. Reported concentrations varied widely, ranging from 3 to 30 p.p.m. for satisfactory results in crude-oil tower overhead systems, as shown in Fig. 3. Seventy-six per cent of the satisfactory applications were in the range of 6 to 12 p.p.m.

Inhibitor concentrations indicated for satisfactory results in light-naphtha streams varied from 5 to 25 p.p.m., as shown in Fig. 4. However, there were two cases involving different inhibitors in sour light naphtha where poor inhibitive results were obtained at concentrations as high as 40 p.p.m. In other instances, good detergent action was reported in crude-oil preheat exchangers at concentrations as low as 3 p.p.m. On an over-all basis, satisfactory results were reported in 87.5% of inhibitor applications.

Metals: No specific case of poor inhibition on steel or admiralty metal was reported except where the inhibitor was ineffective in the system as a whole. Three different inhibitors were reported to be of very limited effectiveness in one application, each involving aluminum condenser tubes.

Fouling: Fouling was attributed to the use of inhibitors in only seven cases.

In three of them, the detergent action caused corrosion products to be suspended in the stream and later accumulate in equipment beyond the point of injection. This type of fouling has been associated with overdosing or too rapid buildup of inhibitor concentrations during the initial stages of injection in a system which had started to foul.

Another type of fouling, often referred to as "gunking," was reported in one application where the inhibitor was not soluble in a light-hydrocarbon stream. This dropout of the active inhibitor ingredient may be likened to propane deasphalting, wherein the high-molecular-weight components are precipitated.

A third type, charring or coking, was reported in one case at 550° F. These last two instances of fouling were misapplications and are reported for information only.

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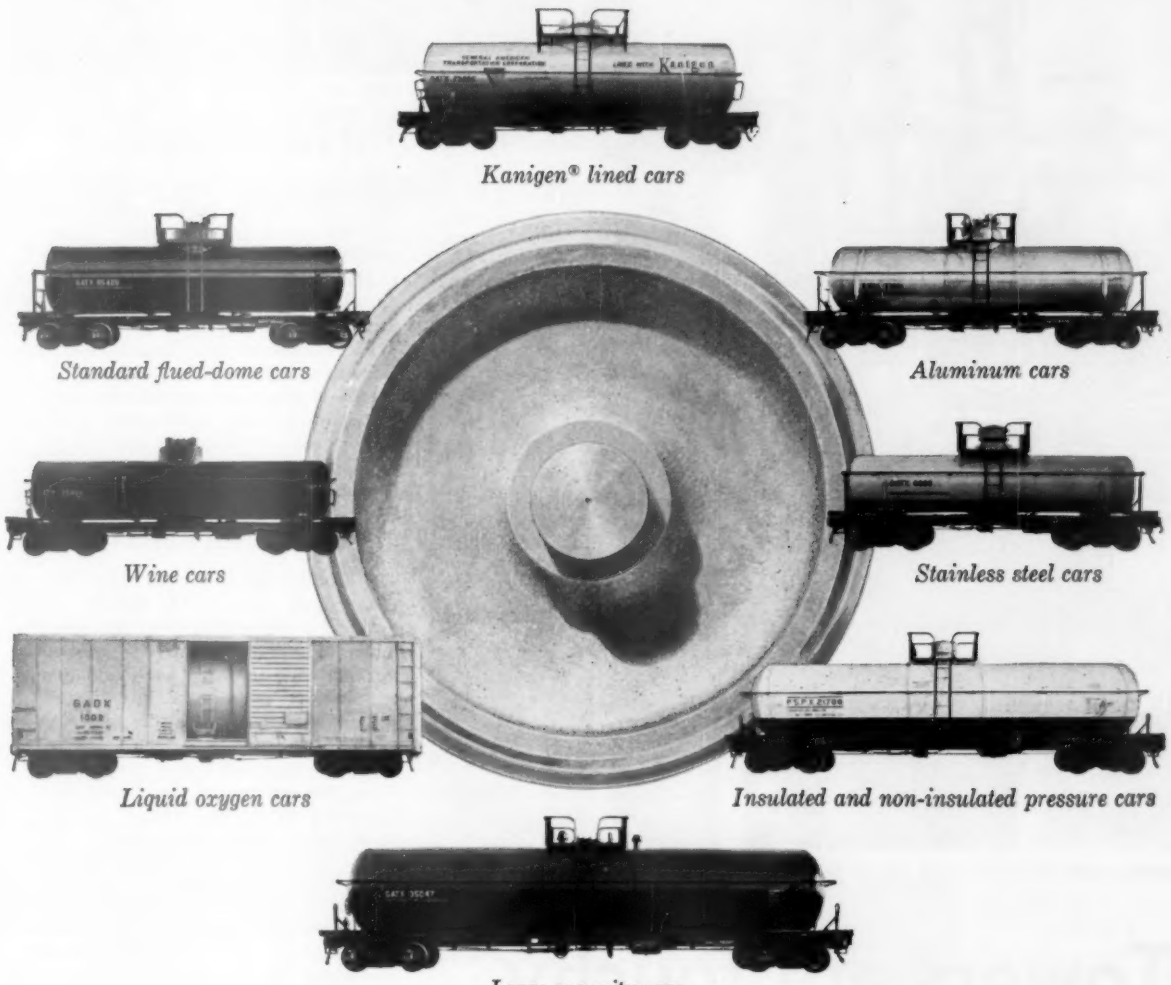

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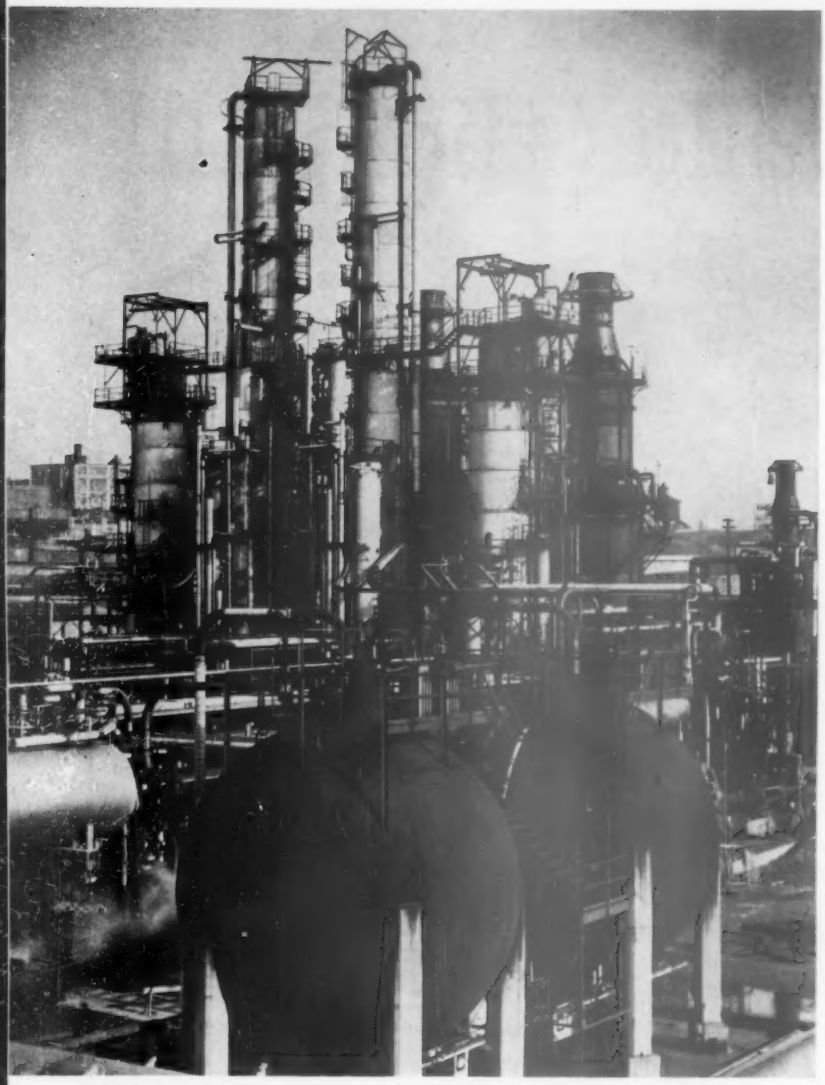

OPERATION of No. 1 crude unit at Sohio's Cleveland refinery shows . . .

Towers are touchy

Coming on and off stream with primary distillation equipment can spell trouble. Here's one company's experience with this problem and an outline of its procedure for

. . . startup of vacuum towers

. . . shutdown of crude-oil towers

BY R. W. BALLMER
Distillation Superintendent,
No. 1 Refinery, Standard Oil Co. (Ohio)
Cleveland

Presented to a session on operating practices during the twenty-fifth midyear meeting of the API's Division of Refining, Detroit, May 11, 1960.

IN 1952 Standard Oil Co. (Ohio) built two identical topping units, naphtha splitters, and vacuum-distillation units at its Cleveland refinery. Light-ends equipment was built to serve both systems.

Combined capacity of these units is now 55,000 bbl. per stream day. Unit runs are 18 months. Major items of equipment are shown in Fig. 1.

Vacuum-Tower Startup

During the first few startups after these units were built, internal explosions upset trays in the vacuum towers. These towers were designed to start up under vacuum on hot reduced crude oil, a procedure now in use.

Fig. 2 shows a simplified flow diagram of a vacuum unit. The unit includes a two pass vertical-tube furnace with a steam superheater in the stack throat, a vacuum tower 13 ft. in diameter, with a 9-ft. top-condensing section and a 6-ft. bottom-stripping section. The over-all height of this tower is 73½ ft.

Tower operation. In operation, 790° F. reduced crude oil is fed to the tower at a pressure of 2 in. Hg absolute; the flashed feed is washed through three bell-cap trays and two entrainment mats to reduce metals content before reaching the midtower gas-oil draw.

Two recycle streams are drawn from this section of the tower and pumped back to the furnace feed line to maintain liquid wash ratio. The upper stream is withdrawn through a stripper and is intermittently taken to storage as a heavy asphalt solvent.

About 90% of the gas oil is condensed across six shower-deck trays and withdrawn at mid-tower. A pump-around system exchanging heat in the crude-oil-preheat train controls this section of the tower.

A reflux system is used to complete total vapor condensation across two bubble-cap trays in the top of the tower.

Tower bottoms pass through two stripping trays and one disengaging tray before leaving the tower.

When these towers were first started up, the procedure was relatively simple and not very time consuming. At the completion of pressure testing and vacuum testing, stream systems were dried out; the top reflux system was loaded with oil from the bottom side-stream of the crude-oil tower; the tower was placed under vacuum; steam was charged to the inlet oil passes of the furnace; a burner was lit; all drains were emptied of water

ENGINEERING NEWS

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In those instances where high temperature oil, containing particles of coke is fired, the National Airoil all steel, "V" port, 9195 plug valve can be used. Although it is not entirely free from port clogging by coke, it can be easily cleared by momentarily opening it wider to flush through any coke build up. This valve is generally not considered as a positive shut off, it should therefore, be provided, up stream and in series, with a suitable shut off valve. This practice should also apply to all oil and steam control valves.

When superheated steam of up to 600°F total temperature and pressures up to 200 psig is the atomizing medium, the better valve is the National Airoil 9077 with steel body and stainless stem.

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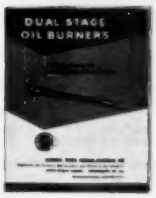

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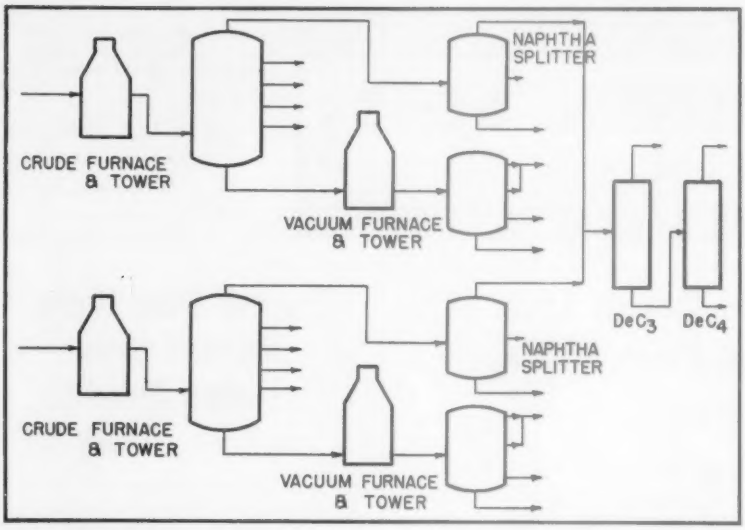


CRUDE-OIL UNITS at Standard of Ohio's Cleveland refinery. Capacity is 55,000 bbl. per stream day. Fig. 1.

as heating took place. When steam of 500° F. was entering the tower, hot reduced crude oil was started slowly to the furnace.

This startup procedure was not adequate to remove water from pockets in the tower, and explosions resulting from the rapid vaporization of water upon the introduction of feed caused tray damage in several cases.

Experience showed that water removal was not a speedy process. The value of completely testing the tower and all auxiliary equipment before starting hot feed became quite apparent. Today vacuum towers are brought to a water-free conditions by use of a flushing oil and superheated steam. All tower circuits are operated on the flushing oil; then, hot feed is introduced.

Startup details. A 150-psig. steam test is held on the vacuum furnace and feed line. A 50-psig. steam test is held on the vacuum tower and auxiliaries. The complete unit is then tested under maximum vacuum, approximately 1 in. Hg absolute pressure, with no steam in the system. At the end of the vacuum test, steam is started to the unit. The vacuum is broken, and condensate is steam-pressured out through drains for the last time.

The evacuation system is then put back in service. At this point the tower is at approximately 200° F., under full vacuum, and much too wet to receive hot feed. The water in the unit must be removed either as a vapor overhead or as a liquid, pumping or draining it as it accumulates at the tower draws. Concurrent operations of heating with superheated steam and flushing and testing with oil are started.

Steam of 150 psig. is opened to the feed line, furnace inlet passes, and steam injection tubes near the furnace outlets. Low-pressure steam is opened to the superheater passes, and one burner is fired. The coil outlet temperatures are raised approximately 75° F. per hour, and the steam is displaced through the tower to the evacuation system.

Water in vertical-tube passes of the furnace must be vaporized or displaced into the tower as early as possible in the startup procedure. The superheater-steam-coil outlet is released into the furnace transfer lines and bled down near the tower injection points. When this steam is dry, it is opened into the two stripping sections.

When this heating operation is in progress, oil is being loaded into the tower. The initial filling of the two top circuits in the tower is made with cold low-pour gas oil. This assures displacement of any large water pockets into the tower under cold conditions. It also provides some dilution to the high-pour flushing oil when it is first introduced at low temperature. An intermediate gas oil, the cut just above reduced crude, is then used to finish the job.

Heavier gas oil is pumped to the top reflux system and this system is kept full and circulating to hold the top tower temperature at approximately 125° F. The gas oil is then turned to the tower through the midtower pumparound circuit at a rate of about 4,000 bbl. per stream day. A trim cooler is used to gradually increase this oil temperature to 300° F. The two recycle circuits are filled from their respective draws as the draw-trays become loaded. An oil level is built in the bottom of the tower.

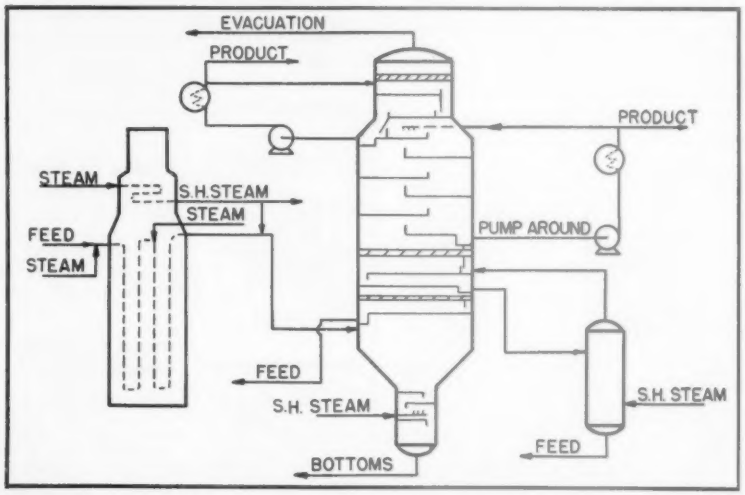
The top reflux and midtower pumparound circuits are operated continuously, checked frequently at pump discharges for water, and bled out to tankage as required to dry up the internal and product circuits.

The recycle streams and tower bottoms are pumped to tankage intermittently to remove water from the tower, to check serviceability of normal and emergency pumpout lines, and to complete the displacement of all auxiliaries.

Hot feed is turned to the furnace when:

1. All pumps on the unit have been in operation.

2. There is no visible evidence of water or emulsion at pump discharges



SCHEMATIC DIAGRAM of a vacuum tower. Unit includes a two-pass vertical-tube furnace with a steam superheater in the stack throat. Fig. 2.

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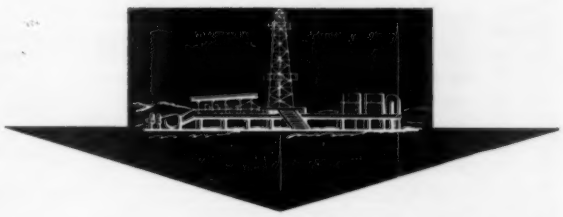

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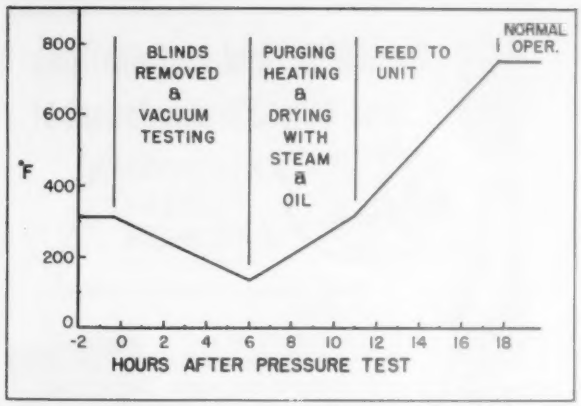
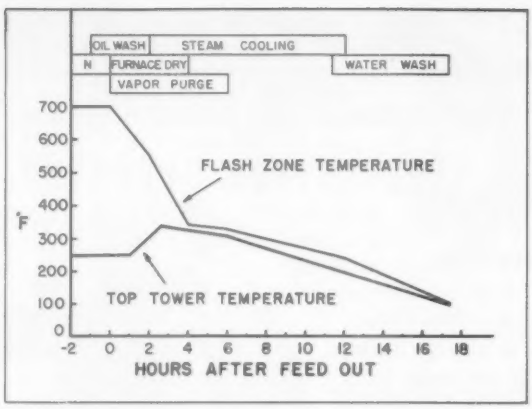


ABOUT 18 HOURS are required to put the unit into normal operation. Graph shows relationship of this time and flash-zone temperature. Fig. 3.



TIME-TEMPERATURE relationship during crude-oil-tower shutdown. Fig. 5.

and low-point drains in the pumping circuits.

3. All exchangers, coolers, bypasses, product lines, and emergency lines have been displaced with dry oil.

4. There is no evidence of major leaks or deficiencies in the furnace.

It has been our experience that a heating level of 275° F. at the bottom of the vacuum tower is necessary to complete this drying process.

Fig. 3 shows a typical startup time-temperature relationship using flash-zone temperatures. It takes about 18 hours to bring the unit completely up on feed rate and temperature after pressure testing is completed, and about 6 hours to remove the 18-in. blind in the barometric leg piping and then to complete the vacuum test on the tower and auxiliaries. Drying and operational testing takes 5 hours. About 7 hours are required to reach normal operating conditions after feed is cut to the unit.

This is time well spent. Certainly, considering that startup time is equivalent to about 0.25% of a normal operating run, this is not the place to strive for higher service factors by taking short cuts.

In this type of startup, steam consumtpion for purging and drying is 40,000 to 60,000 lb., equivalent in volume to about 175 tower displacements. One thousand barrels of gas oil are used in washing down; this is recovered in slop tankage.

This procedure has been established to provide gradual temperature changes throughout the system on startup to eliminate the damage possible from thermal shock and rapid vaporization of water. IT IS NOT A SUBSTITUTE FOR OPERATING EXPERIENCE AND GOOD JUDGMENT.

In using this check list it is very desirable to perform some of these operations simultaneously so as not to prolong the startup.

UNIT _____

DATE _____

I—VACUUM UNIT	CHECKED	TIME
1. Vacuum furnace blanked for testing.		
2. Vacuum furnace tested.		
3. Blanks removed from furnace outlets.		
4. Vessels and lines completely closed.		
5. All blanks removed except blank in barometric leg.		
32. Vacuum pumparound pump lined up to take suction away from tray 6.		
33. *All drains rechecked for water.*		
34. Suction from tray II established with reflux pump.		
35. Suction from tray 6 established with pumparound pump.		
36. Suction from tray 3 established with cylinder stock pump.		
37. Suction from tray I established with recycle pump.		
38. Suction on bottoms tower established with both bottoms pumps.		
39. All drains rechecked for water after suctions established.		
40. Superheater steam added to transfer lines at rate of approximately 500 lb. per hour.		
41. Bottoms quench operating from generator to tower.		
42. Oil from bottom of tower *water free.*		
43. P.D. swung from reflux pump to pumparound pump. Returning to tower through trim cooler.		
44. *Drains checked for water again and drained water free.*		

STARTUP CHECK LIST for putting one of the vacuum units on stream. Other unit and all common auxiliary equipment are on stream. Fig. 4.

Check Lists

A check list itemizes the steps in the plan and functions both as an easy reminder to the operator and as a report of the progress of operations.

Fig. 4 shows extracts of a check list used in putting a vacuum unit on stream. The check list is a guide and is not a substitute for operating experience and good judgment. Items are of a general nature and do not define the details in performing the operation.

Because of the time interval between shutdowns, it is important to review check list prior to entering a shutdown. Changes in operations or facilities may require alterations in the list. In any event, a little reflective thinking prior to cutting feed is worth while.

Crude-Oil-Unit Shutdown

Other phases of turnaround have been rather routine. However, damage to trays in a crude-oil tower during one shutdown put this operation under the microscope.

Damage was caused by exposing the tower internals to cold water and air prematurely. The proper sequence of operations had been followed, but steam cooling of the tower had not been adequate.

Fig. 5 shows the basic steps in regard to time and temperature in taking a crude-oil tower out of service. They might be considered in this manner:

- Furnace-drying period.
- The oil wash.
- Vapor-purging period.
- Steam-cooling period.
- Water-washing period.

Prior to the removal of feed from the unit, coil outlet temperatures are cut and and the oil washdown operation is started by closing off sidestream production draws. After feed is removed, this operation is finished by continuing overhead reflux to the tower for approximately 1 hour. Oil is pumped from all levels of the tower as it accumulates. This short oil wash, followed by subsequent steaming and water washing, leaves the tower basically oil-free for maintenance.

Four hours of drying with 600° F. steam is required to condition furnace tubes for turbining. This is done by introducing a full head of steam into the furnace-inlet passes over low fires and by exhausting the steam into the closed tower. Low-pressure steam is continued to the furnace superheater passes and enters the tower at normal injection points.

At the end of this period, steam is removed from the furnace; the furnace is isolated from the tower and is allowed to cool.

During the furnace-drying period, the oil wash is completed and the vapor purge is in progress. Initially, oil vapors are purged through vapor-recovery equipment, and the final purge is completed by bypassing unit safety valves and steaming directly to the unit flare.

Concurrently, all auxiliary equipment is steaming out to rundown tankage. Close attention must be given to assure cleaning all bypasses, emergency lines, spare pumps, and equipment not in normal service.

After oil washing is completed, about 2 hours from the start of the furnace-drying period, a high volume of live steam is introduced into the tower bottom and all sidestream strippers.

Initially, this steam is removed through the flare system. After the vapor-purging period the tower, strippers, and pumps are opened to the atmosphere at drains and vents.

At this point, it is very important that a positive steam pressure be maintained on all equipment. Steam volume must be such that open points of equipment are sealed from the atmosphere by outward steam flow.

This steaming operation is continued for around 10 hours, with the condensate draining to the atmosphere. This is the period during which localized sources of heat must be quenched or removed prior to introduction of air and water into the tower.

Coke formation, oil pockets on trays caused by plugged weep holes, irregular tray floors, and entrainment mats are the common causes of heat pockets. Steam condensate quenches solids, trapped oils, and, also, displaced oil on plugged or irregular trays.

At the end of the steam-cooling period, a low volume of water is introduced into the top of the tower. The water flow is increased gradually and steam removed from the system. About 6 hours of water washing has been found adequate to reduce the tower temperature to 100° F. and insure a clean tower.

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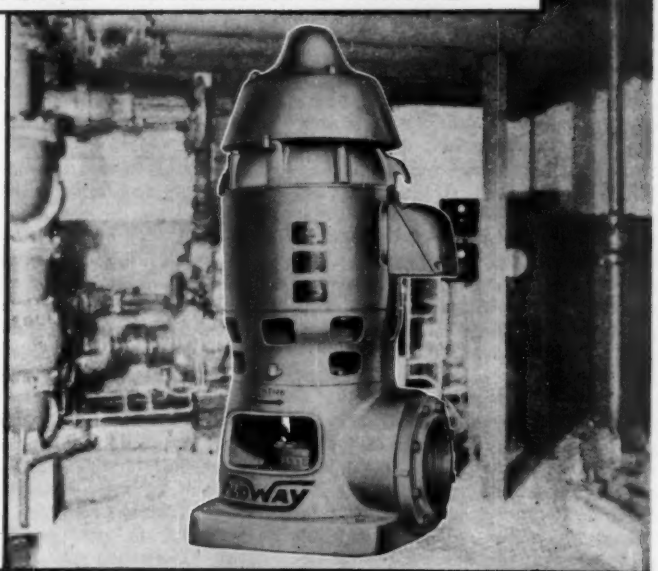

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MUD on Webb County, Texas, well combined high-weight and high-temperature problems. Abnormal formation pressure forced weighting mud to 19 lb. per gal.; high formation temperature (in excess of 400° F.) made lignite necessary to control filter loss.

On Texas Gulf Coast rigs . . .

Planned mud program cuts drilling costs

BY K. D. TANNER AND GEORGE B. GRAY

THE DRILLING OPERATOR on the Texas Gulf Coast now has the opportunity to tailor his mud program to take advantage of new mud materials and to minimize well trouble. Where stuck pipe or casing is a possibility, inhibited muds, oil-wetting agents, and lubricants are often used to reduce sticking tendency.

In some areas loss of circulation has been considered almost inevitable. Many operators now avoid loss by careful control of the flow properties of the mud, thus reducing pressure on the formations.

The lost-circulation problem has been especially bad in high-pressure zones which require heavy mud. Some operators are lowering and closely controlling mud density, thereby cutting the difference between mud and formation pressures. This practice has definitely reduced loss.

High-temperature problems are also being solved. On several "hot" wells, mud type has been changed progressively as the hole deepens and temperature rises. Result is lower overall mud cost and fewer drilling problems.

Aggregated mud systems. For a number of years, almost the only mud types used were lime muds and low-pH muds containing emulsified oil. Since 1956 lime muds have been replaced for many applications by aggregated mud systems such as shale-control, surfactant, and gypsum-treated. Shale-control muds use a controlled-filtrate alkalinity and a high calcium-ion concentration in the filtrate to stabilize shale chemically.

Authors are with Baroid Division, National Lead Co., Houston. Paper presented under title, "Drilling Mud Programs in the Texas Gulf Coast Area," at 1960 spring meeting, API Division of Production, Southern District, San Antonio.

Surfactant muds use heat-stable nonionic surface-active agents along with soluble electrolytes. These flocculate the clay solids in the mud and inhibit clay swelling.

Gypsum filtrate from gyp-treated mud is high in calcium-ion concentration. Ferrochrome lignosulfonate serves as a deflocculant.

Lime-treated muds. The familiar lime mud is still used in about half of the wells that require mud weights as high as 12 lb. per gal. Normally, muds are converted from low-pH to lime-treated muds in anticipation of higher mud-weight requirements and possible contamination by gypsum, salt water, or cement.

The mud usually is converted at a depth such that little or no dilution is required or when mud-weight requirements are low (below 11.0 lb. per gal.). An example of present practice is that of a well in Aransas County. The native shale mud was converted at 5,500 ft. by adding 2 lb. per bbl. caustic soda, 2 lb. per bbl. lignite, 2 lb. per bbl. tannin, 4.5 lb. per bbl. lime, and 10% by volume diesel oil.

After conversion the mud had: weight, 9.7 lb. per gal.; funnel viscosity, 37 seconds; gels, 0-0 g.; filtrate, 9.6 ml.; filtrate alkalinity, 5 ml.; and available lime of 4.0 lb. per bbl. The mud was maintained by a daily treatment of 0.5 lb. per bbl. caustic soda, 1 lb. per bbl. lime, 0.5 lb. per bbl. lignite, 0.3 lb. per bbl. tannin.

Mud weight was raised at 8,400 ft. to 12.6 lb. per gal. Other properties were: funnel viscosity, 50 seconds; gels, 0-0 g.; yield point, 12 lb. per 100 sq. ft.; plastic viscosity, 26 cp.; filtrate, 5.8 ml.; filtrate alkalinity, 3.0 ml.; and available lime, 3.0 lb. per bbl. To reduce the possibility of sticking the casing, 2 lb. per bbl. of oil-soluble surfactant was added to the mud before running 7-in. casing to 10,300 ft.

Gypsum-treated muds. Now gypsum-treated muds are used as often as lime-treated muds. A 14,000-ft. well in Hidalgo County is an example of a gypsum-treated hole. After 13⅜-in. casing had been set at 2,000 ft., a 12¼-in. hole was drilled with native mud. To this mud was added about 100 lb. caustic soda, 200 lb. tannin or lignite, and 50 lb. polyphosphate each day.

At 5,000 ft. the mud had: weight, 10 lb. per gal.; funnel viscosity, 55 seconds; plastic viscosity, 22 cp.; yield point, 10 lb. per 100 sq. ft.; filtrate, 10 ml.; and pH, 9. At 5,900 ft., mud weight was increased to 11 lb. per gal. and the tannin, lignite, and polyphosphate were discontinued. Ferrochrome lignosulfonate was used as a deflocculant.

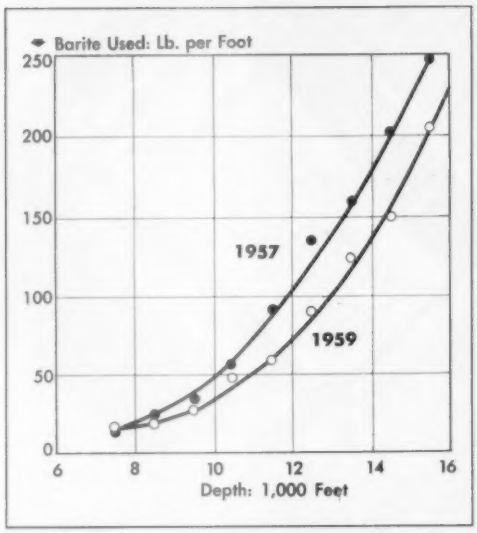
At 6,500 ft. gypsum treatment was begun by adding for each barrel of mud: 5 lb. gypsum; 3 lb. ferrochrome lignosulfonate; and 0.5 lb. caustic soda. At the same time, 10% by volume of diesel oil was added and mud weight raised to 13 lb. per gal. Calcium-ion concentration in the filtrate was 900 p.p.m.

As drilling progressed, normal additions of chemicals per day were: 500 lb. ferrochrome lignosulfonate; 300 lb. gypsum; 50 lb. caustic soda; and 50 lb. carboxymethyl-cellulose. Representative properties were: funnel viscosity, 45 seconds; plastic viscosity, 23 cp.; yield point, 8 lb. per 100 sq. ft.; filtrate, 7 ml.

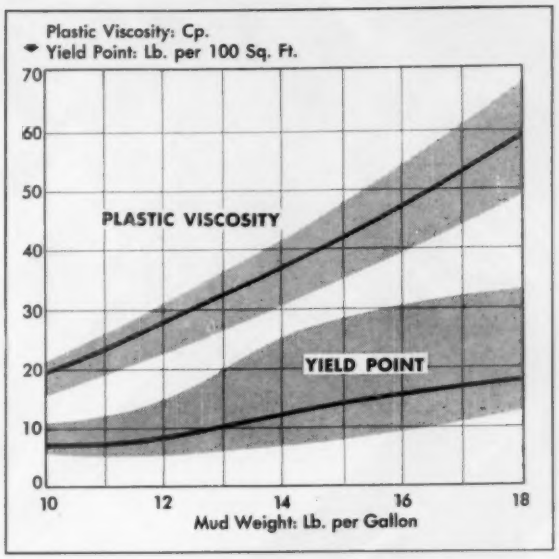
At 7,500 ft. 9⅝-in. casing was set. Mud weight was increased to 14 lb. per gal. Fine mica and plastic flakes were added to prevent loss of circulation. Mud weight was increased progressively: at 9,000 ft. to 15 lb. per gal.; 10,000 ft. to 16 lb. per gal.; 10,200 ft. to 16.8 lb. per gal.; 10,600 ft. to 17.2 lb. per gal.; and 12,000 ft. to 17.4 lb. per gal.

At 12,000 ft. 7-in. casing was set. Mud weight was increased to 18 lb. per gal.

A centrifuge was installed and mud



AVERAGE BARITE CONSUMPTION in representative wells of the Texas Gulf Coast. Fig. 1.



VARIATION in minimum and maximum values of plastic viscosity and yield point with mud weight. Fig. 2.

weight was maintained at 18 lb. per gal. while 5⅝-in. hole was drilled to 14,100 ft. In this period representative chemical treatments per barrel of mud per day were: 1 lb. ferrochrome lignosulfonate; 0.3 lb. gypsum; 0.2 lb. lime or caustic soda; and 0.05 lb. CMC. Typical properties were: funnel viscosity, 55 seconds; plastic viscosity, 61 cp.; yield point, 15 lb. per 100 sq. ft.; filtrate, 3.2 ml.; calcium in filtrate, 900 p.p.m.

Mud weight. Mud-weight requirements vary widely in the Texas Gulf Coast; and in some areas, pressures are abnormal at relatively shallow depths. Because of the localized incidence of high pressures, you cannot wholly rely on broad surveys. In general, 18 lb. per gal. is the maximum density needed, although in Webb County a 19-lb. per gal. mud was used while drilling from 14,000 to 16,537 ft.

Even heavier muds occasionally are needed to bring a well under control, and muds weighing as much as 30 lb. per gal. can be prepared with barite, galena, ferrochrome lignosulfonate, drilling-mud surfactant (DMS), and CMC.

Barite accounts for roughly two-thirds of the cost of mud materials used. Consequently, proper control of weight is important in design of the mud program. Quantity of barite used in drilling depends not only on the density of the mud required by pressure of the formation; it also depends on volume of mud in the system, time spent in drilling, loss of circulation, methods used to maintain the mud, and several other factors.

Several of these factors relate directly to depth. So, a plot was made of the consumption of barite (in pounds per foot of hole) for about 100 wells drilled in 1959 to depths of 7,000 ft. to 16,000 ft. There is a very wide scatter of points as was to be expected. When, however, the average amount of barite (lb. per ft.) for each 1,000-ft. interval of depth was plotted at the midpoint of the depth interval, the increase in consumption with depth is obvious.

A comparison was made with about the same number of wells drilled in 1957. The results are shown in Fig. 1. If you accept this method of averaging such widely varying quantities, the conclusion is obvious: Much less barite was used per foot of hole in deep wells in 1959 than was used in 1957.

The lower consumption of barite may be due to:

1. Wider use of the centrifuge and cyclone to reclaim mud.
2. Reuse of mud from well to well.
3. Improved mud technology, including the wider use of so-called inhibited muds and more attention to flow properties of weighted muds.

Flow properties. Recently, more field people have come to accept the importance of measuring and controlling flow properties of the drilling mud. An instrument has been developed to measure directly the plastic viscosity and yield point. And drilling engineers have become quite interested in these measurements because they may be the key to better drilling performance. That is, drilling rate tends to go down as mud viscosity goes up. Turbulent flow in the annulus removes cuttings better, and critical velocity is affected by yield point.

Flow properties of the mud are especially important with heavy muds because of the greater possibility of losing circulation.

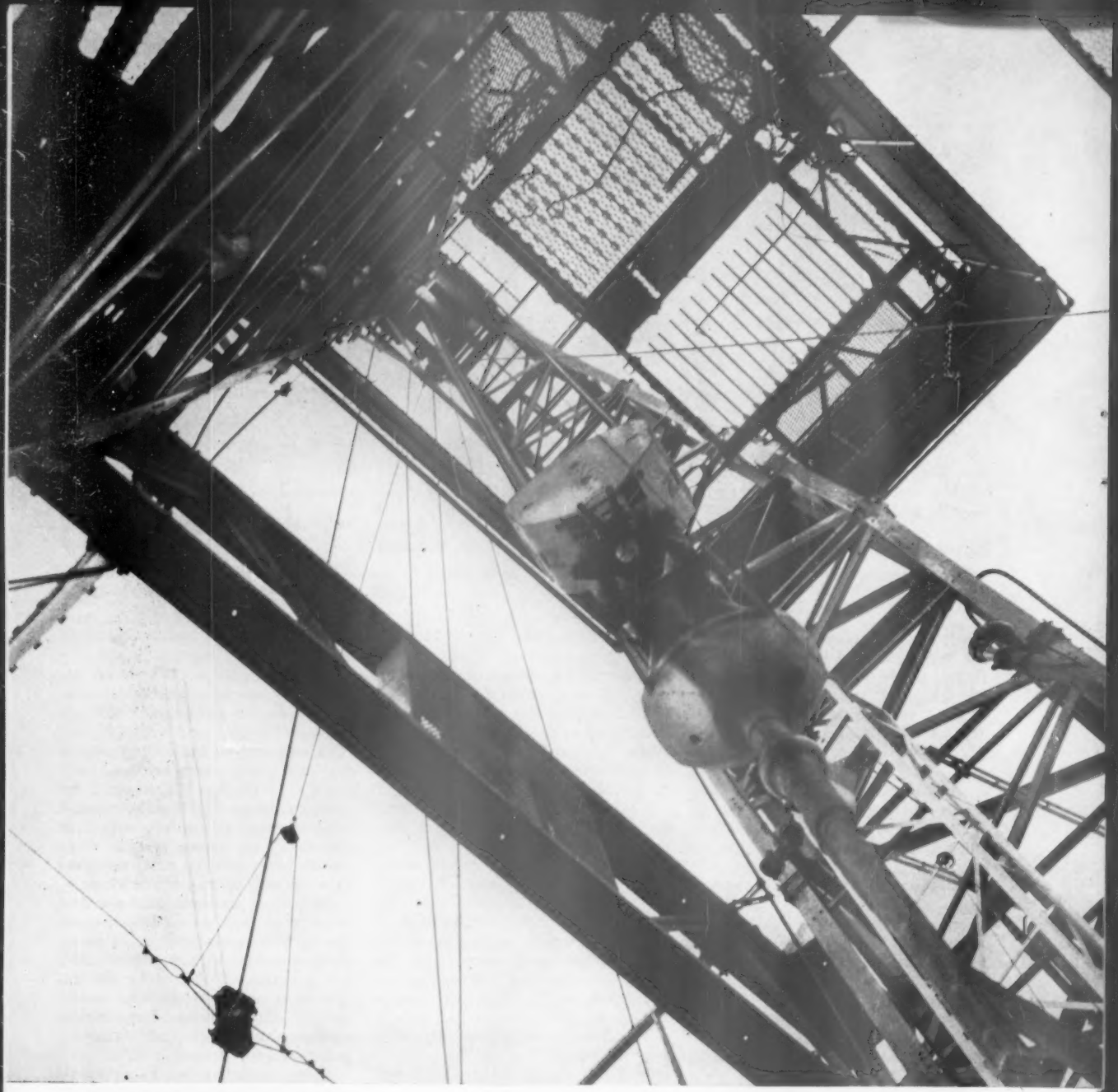
Surveys of field muds show a wide range of plastic viscosities and yield points. This range is indicated by shaded areas in Fig. 2. The average values for mud properties accepted as satisfactory are shown as solid lines. Usually, mud costs set acceptable limits which may or may not be ideal.

Here is an example of the differences in pressure drops that may be found. Calculation was made based on these conditions: pump output, 400 gal. per min.; 9⅞-in. hole; 4½-in. drill pipe; depth, 10,000 ft.; 16-lb. per gal. muds, having minimum and maximum values of plastic viscosity and yield point from Fig. 2.

Using minimum values, pressure drop in the annulus was 101 psi. At maximum values, it was 281 psi. This difference in pressure is equivalent to a difference of 0.35 lb. per gal. in mud weight while circulating. Such an amount sometimes is the difference between losing mud or maintaining circulation.

Drilled solids are being removed both by mechanical separation from the barite and by dilution. Character of the drilled solids is controlled by the chemical action of deflocculants, electrolytes, and surfactants. Aggregated mud systems reduce the drilled solids that enter the mud and also reduce the total number of particles present.

Fig. 3 shows the normal range in solids content for gypsum-treated



Bethlehem Rope Serves Louisiana Drill Barge. Here you are looking from the drill floor of the Two-R Drilling Co. barge in Barataria Bay, near New Orleans. It's State Unit No. 2, Well No. 1, being drilled for Texaco Inc. At the time of the photograph, the drilling depth was about 14,700 ft. The Bethlehem Wire Rope, 1⅜ in. 6 x 19 Formset Purple Strand, right lay, with IWRC, in service on its fifth well, was still in good condition, and showed a potential of many additional ton miles, due largely to a Bethlehem-recommended pull-through and cut-off program.

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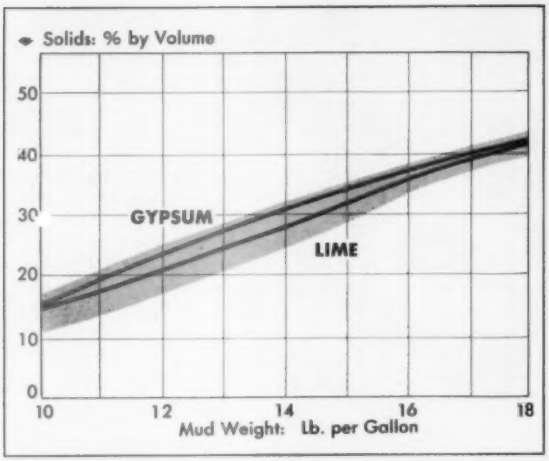
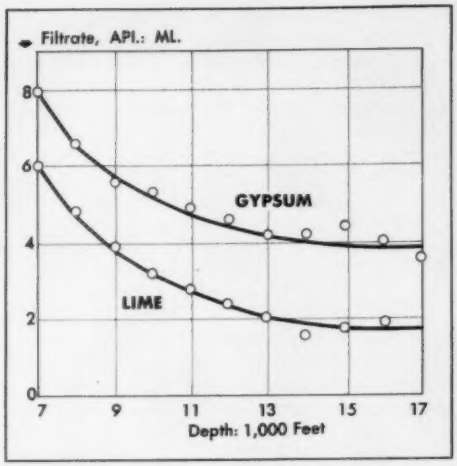


RELATION between solids content and density of typical gypsum-treated and lime-treated muds. Fig. 3.



COMPARISON of average filtration rate of lime and gypsum muds at various depths. Fig. 4.

muds and lime-treated muds. In general, gypsum-treated muds tolerate more solids than do lime-treated muds.

Non-ionic surfactants have been added to various types of muds other than those in which the surfactant is regarded as a primary constituent. For example, when 5 lb. per bbl. of DMS was added to a lime mud in Jefferson County, the funnel viscosity dropped from 81 sec. to 65 sec.; and gels fell from 0-20 g. to 0-0 g. Pilot tests had shown that the usual components of a lime mud were ineffective.

DMS was also used as an aid in controlling flow properties of a gypsum-treated mud containing ferrochrome lignosulfonate. The DMS was continued after the gypsum-treated mud was converted to lignite-sodium surfactant mud.

Filtrate. With muds containing salts of calcium, potassium, and other electrolytes in filtrate, higher filtration rates are acceptable than with muds having relatively electrolyte-free filtrates. Swelling, dispersion, and accompanying sloughing of shales are not as severe as in the case of freshwater filtrates.

Average API filtrates were tabulated by depth for some 400 wells drilled since 1957 with muds treated with lime and with gypsum. Fig. 4 shows that the average API filtrate of gyp muds was higher than for lime-treated muds at the same depth. This fact might be expected from the fact that less starch and more CMC and ferrochrome lignosulfonate are being used for control of filtration.

Filtration can now be measured at temperatures above 400° F. And, in deeper drilling mud treatments are being based on these tests rather than on API tests. Around 350° F. sodium chloride can be substituted for gypsum as an electrolyte, and the sodium surfactant mud can be used to depths where temperatures rise above 400° F. This substitution of electrolytes has been necesasry to avoid the interference of calcium ion with filtration-reducing materials stable at this temperature.

Lignite has been used for filtration control in a sodium surfactant mud in Webb County. Filtration rates were as low as 5 ml. in 30 minutes at 375° F. and 500 psi. Once when the API filtrate was 4 ml., the filtrate at 375° F. and 500° F. psi. was 60 ml. After adding 10 lb. per bbl. of lignite, the API filtrate was 2 ml. while the filtrate at 375° F. and 500 psi. was 8 ml. Lignite appears to be capable of maintaining reasonable filtration rates at temperatures above any bottomhole temperatures encountered thus far.

In some areas, electrical logs can be better interpreted if low-filtration muds are used in drilling. In the upper Gulf Coast, for example, satisfactory electrical logs can be made of the low-porosity Wilcox sands when drilled with lime-treated mud having a resistivity of 1 ohm at 75° F., provided the filtrate is less than 3 ml.

Formerly, salt was added to lower the resistivity and the focused type of resistivity measurement was used.

Lubrication. There may be three types of lubrication in drilling muds. Hydrodynamic lubrication is that provided by the viscosity of the mud itself; it is added by emulsifying oil in mud with lignite or similar emulsifiers. This type lubrication has been used for a number of years, mainly to raise drilling rate and improve hole conditions.

Boundary lubrication is obtained by adding a polar material, such as an oil-soluble emulsifier, which adheres strongly to the metal surfaces. This type of lubrication has been used for the past 2 years as a means of reducing differential sticking. An oil-soluble surfactant was added to a mud in Kenedy County when the drill pipe could not be left motionless long enough to make a connection without the pipe sticking. After 4 lb. per bbl. of the material was added to a lime mud containing 12% diesel oil, this trouble stopped.

The third type of lubrication is extreme-pressure lubrication. Extreme-pressure lubrication for muds were originally intended to lubricate bearing surfaces and preventing metal-to-metal contact at high pressures. The emphasis was on lubricating bit bearings. E.p. lubricants are now being added to muds to improve lubrication of the drill string, prevent stuck pipe, and reduce torque.

Presently lubricants for muds are evaluated principally by the extreme-pressure load test, quantity of oil present, and performance in the hole.

Loss of circulation. In most Gulf Coast drilling, fracturing is considered to be the biggest single cause of loss of circulation. There are ways to combat such loss of circulation. Pressure on the formation can be reduced by decreasing either the mud density or pressure drop in the annulus, or both. In many cases, cutting mud weight is impractical. Flow properties, however, can be adjusted for a minimum pressure on the formation.

Inhibited mud can be used to keep the hole more nearly in gage so that the surface area on which the pressure acts is a minimum.

The barite-attapulgite squeeze has been used with success. A mud is pre-

pared using barite to increase the weight to that of the mud in the system. Attapulgite clay is used to suspend the barite, and various loss-of-circulation materials, are added. Filtration rate of this composition is high. The slurry is then squeezed into the zone of loss and a plug formed by the loss of water from the mud.

Returns were lost on a well in Galveston County, being drilled with 17.4 lb. per gal. mud. A 100-bbl. batch of mud was mixed by adding 10 lb. per gal. of attapulgite to water and adding barite to increase the mud weight to 17.4 lb. per gal. Approximately 20 lb. per bbl. total of nuthulls, mica, and fibrous materials were then added. The mixture was squeezed at the zone of loss in two stages and allowed to set for 24 hours. Drilling continued with no further loss of returns.

Completion fluids. Fluid for completion must fill several needs. It must protect the productive sand from particle invasion and harmful filtrate invasion. Various salt solutions provide this protection since they contain no solids and the filtrate causes a minimum of clay swelling in bentonitic sands.

Filtration can be reduced in these fluids by gums and starch. Muds in which oil is the continuous phase provide a similar protection to these sands.

Often a weighted fluid must be left in the annulus on completion. In many cases this fluid needs to remain pumpable even after being subjected to high temperatures for long periods. It should be noncorrosive.

Muds that meet these requirements have been prepared using oil and the continuous phase. Water-base muds have been freshly prepared with barite, bentonite, and CMC or with barite, attapulgite, and gypsum. Gypsum-treated muds used in the drilling of the well have been used for this purpose after proper adjustment of pH and solids content.

Planning the mud program. Here are two examples of how carefully planned mud programs solved drilling problems:

A Jasper County well was to be drilled in an area that required high-weight muds. There had been serious loss of circulation on two previous wells and mud costs approached $200,000. A plan was made trying to reduce mud costs.

Static bottom-hole pressure on a previous well was 8,886 psi. This pressure would require a 15.7-lb. per gal. mud with no differential pressure. A 16.2-lb. per gal. mud would provide 300-psi. differential, which is considered low.

By using a small differential pressure, however, there would be less likelihood of loss of circulation. And, with good drilling practices, there would be little danger of a blowout. Circulating pressure should be as near to the static pressure as possible.

To meet these conditions, a minimum plastic viscosity, and—most important—a minimum yield point should be maintained. A centrifuge was recommended to keep low-specific-gravity solids at a minimum.

Close adherence to these recommendations resulted in a reduction of mud costs from $200,000 to $39,000.

A 20,000-ft. test was planned for South Texas. It was recommended that the mud be converted to a gyp oil-emulsion mud at 3,000 ft. This mud should improve chances for gage hole and a good cement job on the surface casing to be set at 7,000 ft. DMS was to be added when the formations became more consolidated.

When bottom-hole temperature reached 350° F., or at a time when filtration control became difficult, the calcium ion was to be removed from the filtrate, salt added, and lignite used for filtration control to total depth.

If differential sticking became a problem, an oil-soluble surfactant was to be added to minimize the danger.

Flow properties were to be controlled for minimum yield point and plastic viscosity to minimize danger of loss of circulation.

A centrifuge was to be used to discard drilled solids and conserve barite.

In the actual drilling of the well a low-pH mud treated with caustic soda, ferrochrome lignosulfonate, and quebracho was used to 6,400 ft. where 13⅜-in. surface casing was set. This mud was converted to a gypsum-treated mud in casing using 6 lb. per bbl. gypsum, 6.5 lb. per bbl. ferrochrome lignosulfate, and 1 lb. per bbl. caustic soda.

After conversion, the mud had: weight, 10.3 lb. per gal.; funnel viscosity, 57 seconds; gels, 0-0 g.; plastic viscosity, 28 cp.: yield point, 5 lb. per 100 sq. ft.; filtrate, 11 ml.; calcium ion, 1,080 p.p.m.

The mud was maintained using ferrochrome lignosulfonate, caustic soda gypsum, and CMC to 10,338 ft. where a 9⅝-in. liner was set. Mud properties at this depth were: weight 13.0 lb. per gal.; funnel viscosity, 55 seconds; gels, 0.5 g.; plastic viscosity, 41 cp.; yield point, 15 lb. per 100 sq. ft.; filtrate 3.6 ml.; 1,640 p.p.m. calcium; oil, 9%; solids 26%.

At 12,000 ft., 4 lb. per bbl. of DMS was added to the mud. Mud properties after addition were: Weight 15.5 lb. per gal.; viscosity, 56 seconds; gels, 0.5 g.; plastic viscosity, 41 cp.; yield point, 13 lb. per 100 sq. ft.; filtrate, 2.8 ml.; calcium, 1,680 p.p.m.; oil, 10%; and solids, 28%.

The gypsum-treated mud was maintained to 14,791 and 7-in. casing was set. At this depth, temperature above 400° F. was reported, indicating that filtration control by means of ferrochrome lignosulfonate and CMC, would soon become ineffective.

The mud was treated with soda ash and bicarbonate of soda to remove calcium ion and lignite was added for filtration control. A filtration rate of 10 ml. in 30 minutes at 400° F. and 500 psi. was maintained thereafter to a depth of 19,200 ft. A bottom-hole temperature of 425° F. was recorded at this depth.

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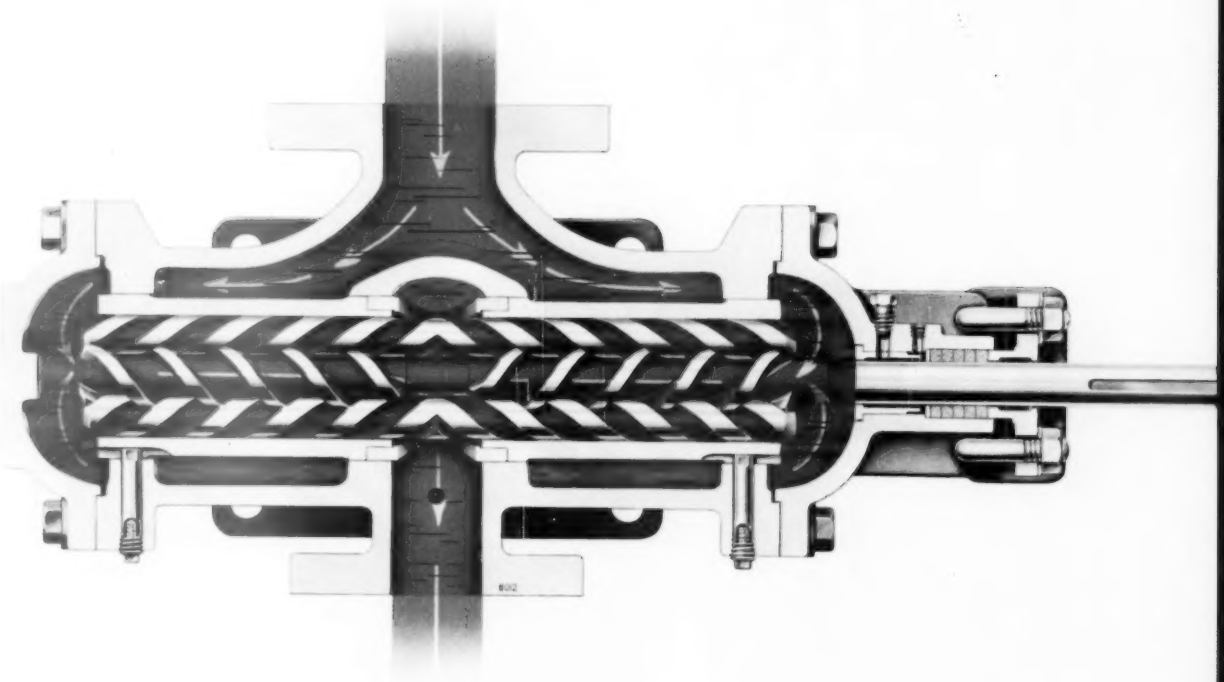

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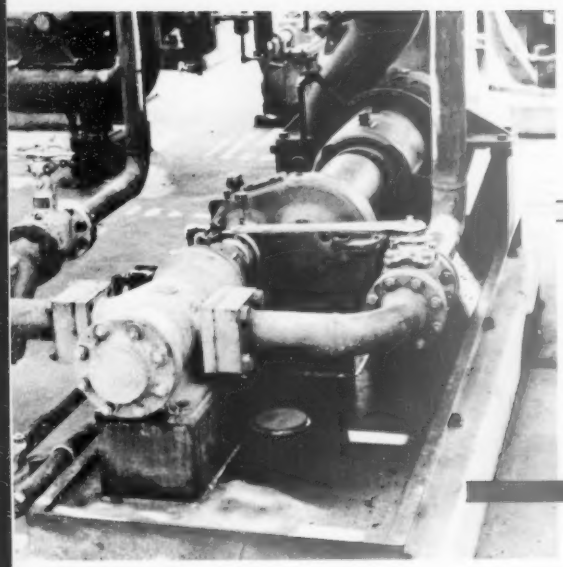

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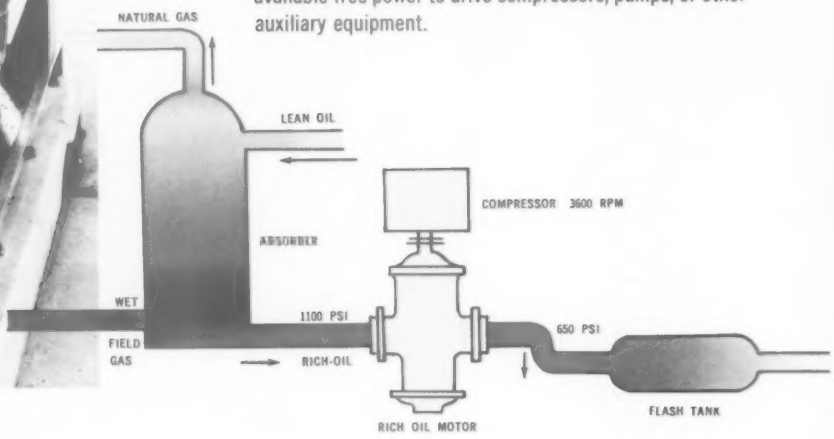

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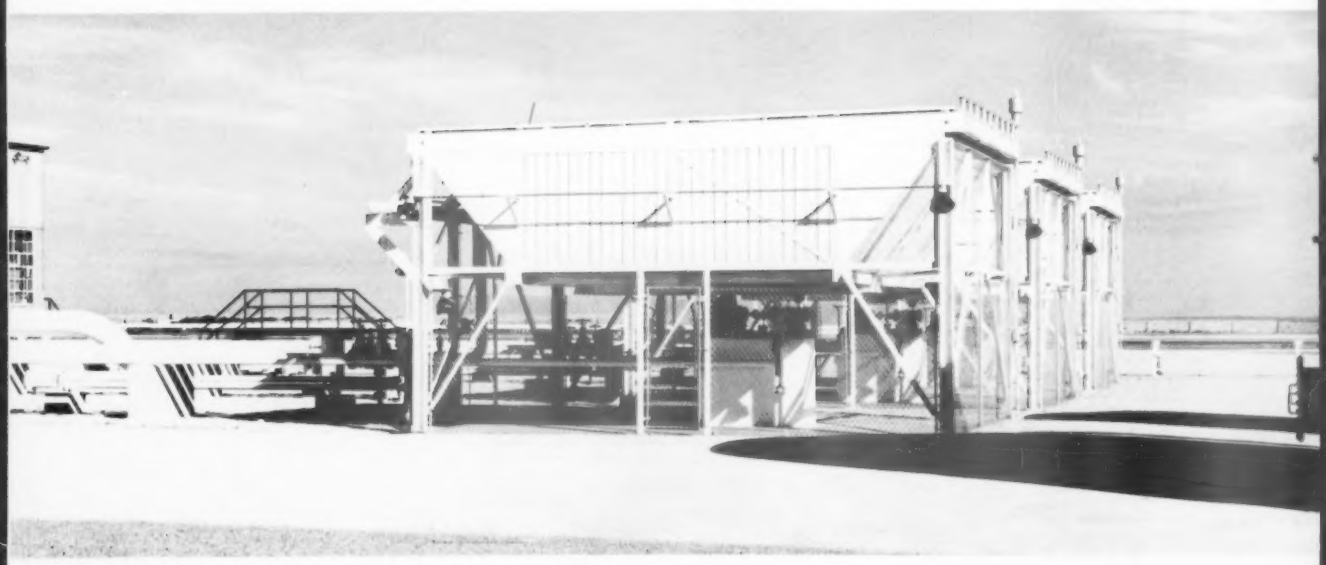


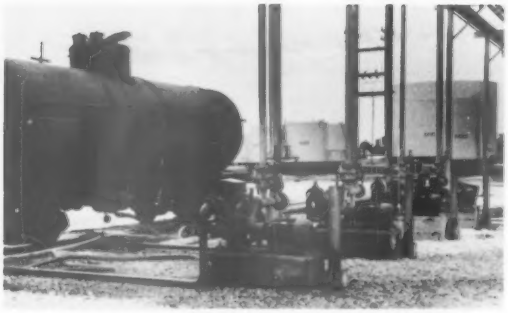
THE IMO AS A CRUDE OIL PUMP

Eight IMO units are pumping crude in this Venezuelan Sun Oil Company installation on the first fully automatic flow station on Lake Maracaibo, Venezuela. Each pump is designed to deliver 12,500 b/d at 1000 psig at a direct drive speed of 1750 rpm.

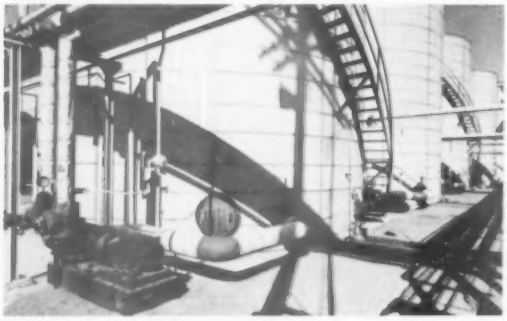
Designed, fabricated and installed by J. Ray McDermott & Company, Inc. of New Orleans, La.

OTHER USES OF THE IMO PUMP IN THE PETROLEUM INDUSTRY

IMO actuates sucker rod in this hydraulic pumping jack. Pressures to 300 psi.

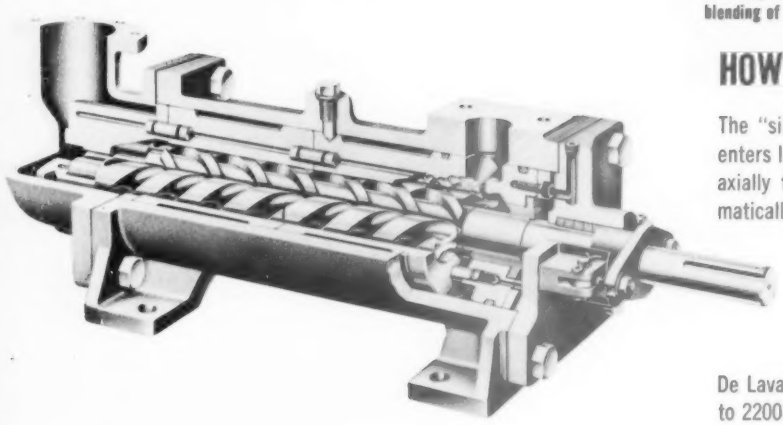


This tank car unloading application demonstrates the versatility of the IMO pump for practically any oil handling operation.



IMO pump for road oil blending. Handles 295 gpm of asphalt at 300 F. 950 SSU, and 50 psi.

Remotely controlled, the trouble-free IMO is used in packaging and blending of lube oil.



HOW THE IMO PUMP WORKS

The "single-end" IMO pump is illustrated at left. Fluid enters large inlet opening at outboard end and is moved axially to discharge without pulsation through mathematically calculated thread form.

The "double-end" design is illustrated on the front cover.

De Laval IMO pumps have only three rotating parts and do not require timing gears.

De Laval IMO pumps are capable of pressures from 10 to 2200 psi and capacities from 100 b/d to 67,000 b/d.

Illustrated are a few applications where the De Laval IMO pump has proved its reliability and efficiency. If you have a specific oil handling problem, a De Laval representative will be glad to discuss it with you.

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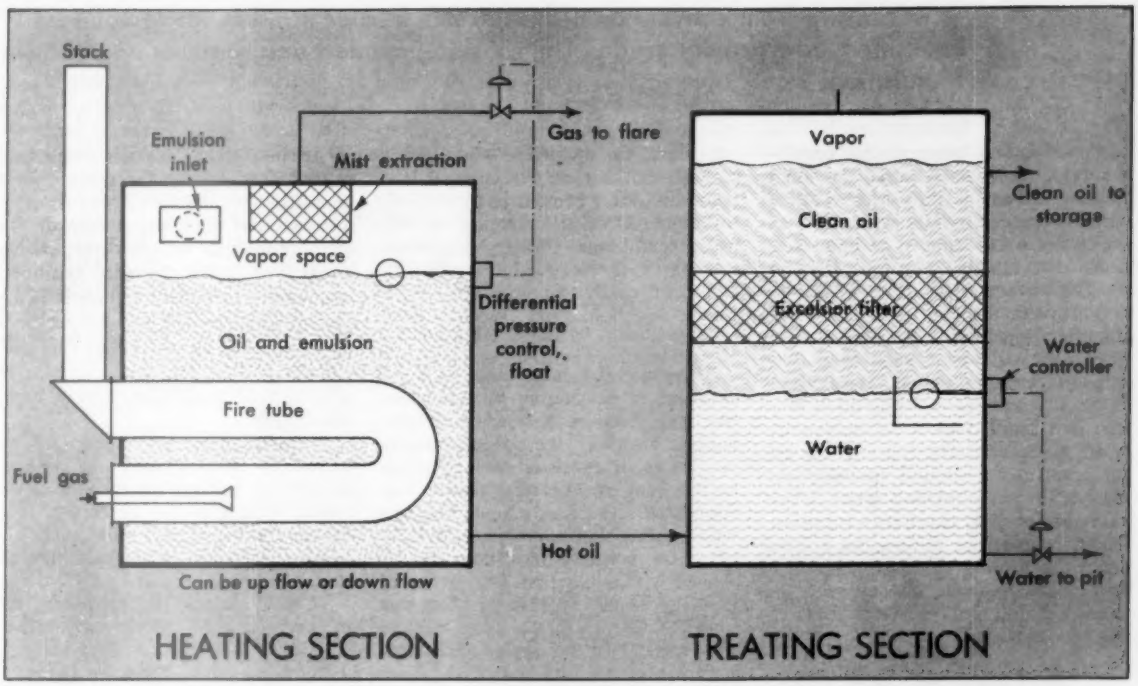

A NEW-TYPE HEATER for hard-to-break emulsions shows an inlet port at the top of the heater section. Emulsion flows downward in the heater section, left, and upward in the treating section, right. As fluid comes in contact with the excelsior filter, water is separated out and drops to the treating-section bottom. This same basic design can be used on treaters with upward flow in the heater section by locating the inlet port at bottom of vessel.

New treater passes Venezuelan field test

BY C. E. DE YOUNG

. . . who is a consulting engineer specializing in production technology. He has many years of design and application experience with all types of gas and oil-processing equipment, and in major world producing areas. He holds an engineering degree from the University of Houston.

FIELD TESTS conducted in Venezuela during 1957-1958 have resulted in a major breakthrough in heat-type treater design. Testing was carried out on severe asphaltic oil-water emulsions. Factors contributing to efficient demulsification of difficult oil-field crudes were viewed with a completely fresh approach. Further testing to date, with units built along the new lines, has confirmed earlier results, and exceeded initial expectations. The result?—Greater lease economy.

A severely emulsified crude was chosen to provide a completely accurate comparative means of evaluation. High-gravity, easy-to-treat, paraffin-base oil-water emulsions, accompanied by highly saline water, can often be broken by application of small amounts of chemicals or heat, and short washing and settling periods.

On viscous, asphaltic crudes, these methods are usually inadequate to achieve crude of salable quality. Forced coalescence of minute water particles, through intimate contact with wood excelsior, provides the added means of efficient dewatering.

Flow pattern. The incoming crude and emulsion enter the heating section of the treater, Fig. 1, and flow downward over the fire tubes. Solution gas is liberated due to the temperature increase, and this gas moves upward through the cool liquid in a countercurrent manner. Heavy fractions are condensed back into the oil phase, and the light fractions continue to escape. On reaching the liquid surface, these light ends assist in the release of gases trapped in the form of foam. Liberated solution and emulsified gases are then separated from entrained liquid prior to discharge.

With rising temperature, most of the water falls rapidly through the body of oil around the fire tube, and goes out the bottom of the heating

• Departing from conventional design, this treater handles large volumes of emulsified, low-gravity crude. Unit is skid-mounted and requires no concrete foundation.

compartment at temperatures considerably lower than required for final treating. The heating section then contains predominantly water-free oil which has been denuded of light fractions that readily coke on fire-tube heating surfaces. Absence of water in contact with the fire tubes minimizes mineral deposition.

Hot oil and warm water then flow into the treating vessel. Here water is quickly withdrawn while oil is broken into small rivulets for maximum-wash water contact. Nearing the filter area, crude oil and emulsion are washed by downflowing water previously removed by excelsior adsorption. Then, by pressure differential exerted from the heating compartment, oil is forced into intimate contact with the excelsior, and final efficient dewatering is achieved.

Desalting. Even with difficult-to-treat asphaltic crudes ranging down to 12° API gravity, treated oils containing 0.5% water, or less, are normal. This high treating efficiency is important to desalting when it is realized that salt control is dependent upon low water content in treated oil. By more effective reduction of oil-water emulsions during first-stage treating it is frequently possible to eliminate costly facilities for fresh water injection, and further final treating.

Filter material. Importance of wood excelsior in dewatering oil emulsions has long been recognized in treater design. However, the proper quantity and usage of excelsior was unknown until testing of the new treater was completed. Previously unappreciated was the fact that approximately 95% of water particles in crude are removed within the first few inches of excelsior contact. This implies that multiple filter sections, long used in tall, vertical treater design, are more detrimental than beneficial, since treating ability and capacity are not materially increased. Detrimental effect results from greater hydrostatic head required to overcome greater filter friction loss. This friction loss is further compounded by some treater manufacturers in crossflowing through the excelsior sections, needlessly increasing distance the oil travels. Rising liquid level in the degassing chamber, required to increase hydrostatic head, quickly limits treater liquid capacity as oil approaches the gas outlet. This contributes to the low rates obtainable with vertical treaters on foamy, high-gravity oils.

In many cases preheaters are required to reduce foam in vertical treaters to achieve reasonable liquid rates. This may be necessary even though the treater alone has sufficient heating capacity to provide the required temperature rise.

A solid column of nonfoamy oil, of average API gravity, requires roughly a 3-ft. rise in level to build 1 lb. of pressure. When oil weight is reduced by gas bubbles or composition, it is readily apparent why gas outlet "carryover" is so prevalent. In the new treating concept this adverse

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effect is eliminated since energy to force the oil through the excelsior section is applied in the form of greater pressure differential. Rather than being limited from a few ounces to 1 lb. of increased hydrostatic head, these new treaters can continue to operate effectively and treat efficiently with filter differential pressures as high as internal construction will allow.

This latter factor, ability to operate and treat at filter pressure differentials of several pounds, is an important consideration to the producer. What this means is that the filter section need not be replaced when plugging creates a pound or so of differential pressure, but can be used until the differential reaches several pounds. With filter replacement time, frequently as high as 8 to 10 producing days per year, the importance of extending filter life is very evident.

Domestically, savings resulting from long filter life can usually amount to 75 to 80% reduction in labor and material costs. Overseas, however, the more important factors of inability to make up production losses due to down time, and high water-transportation costs of shipping excelsior from the U. S., makes extending filter life a major consideration in evaluations of various treating methods.

Excelsior is generally made from pine, poplar, or spruce. Specifications control resin content, strand thickness, and length. These factors are important to adsorptive ability and capillary action. Old, brittle excelsior should not be used since it breaks and packs too tightly during filter replacement. In any type of oil service the excelsior should always be water-wetted prior to contact with oil. This is particularly required in asphalt service where experience has frequently established prewetting as the difference between success or failure.

Heat capacity. These new units are generally built with heat-capacity ratings in the range of 3,000,000 B.t.u. per hour. This amount of heat is needed because of high rate of flow of emulsified oil through the unit.

Treating ability. Generally, the new style of treaters for asphaltic service will process around 300% more crude than a comparable size vertical, and cost roughly 50% more. Besides much greater treating capacity per initial dollar investment, the new type treaters also provide these advantages.

1. Complete packaging with all piping, valves, controls, etc., mounted.
2. Skid mounted.
3. No concrete foundation or overhead piping.
4. All parts accessible to personnel.
5. Low shipping cost per barrel of treating capacity.

Use of these treaters has thus far been primarily confined to overseas areas, and on hard-to-treat asphaltic emulsions. However, they are equally as well suited to high-gravity, paraffin-base crudes. Addition of a gravity-conserving device, not generally required on most asphalt-crude applications, will maintain crude gravity while allowing higher treating efficiencies at reduced costs.

Capacities. Treater capacities are empirically derived from known performance on crudes of known composition and characteristics, and upon "educated" guess. This allows considerable flexibility of rate selection since each manufacturer's system is designed to emphasize a different facet of the approach to treating. It is important to remember that plugging rate of the filter, and thus frequency of normal down time for maintenance and repairs, is a function of crude composition, solids in the crude, and liquid throughput rates. Thus, while very high oil throughputs may be possible with a new, clean, unit, treating ability declines more quickly than if moderate rates are used.

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ACCESS TO BEARING SEALS shows on this 8¾-in. 3-cone bit. Other than this feature, there is little about the appearance of the bit to indicate the presence of the bearing seal. Hughes Tool claims this is the first practical seal ever developed for bit bearings.

BEARING SEAL undergoing tests in the laboratory. To make certain of design, individual cones were run submerged in mud at loads similar to those used in actual drilling. Bits run in the field were torn down after completing their runs to make certain that bearing lubricant was still in place.

Sealed bearings promise longer runs for hard-formation bits

BY ED McGHEE
Drilling Editor

THE FIRST practical bearing seal for rock bits has been announced by Hughes Tool Co., Houston.

Bits with its bearing seal, Hughes says, still have the same lubricant in the bearings after a long run in the hole that they did when first run in. This is the first time that any rock-bit manufacturer has made such a claim.

With the bearing lubricant sealed in, Hughes observes, the mud in the hole is sealed out. And, almost all of the common materials in mud shorten the life of the bearing. Even tap water, Hughes says, causes bearings to wear much faster than they would in a good lubricant. Sand, clay, and chemicals almost universally found in drilling mud, are much more injurious to bit bearings.

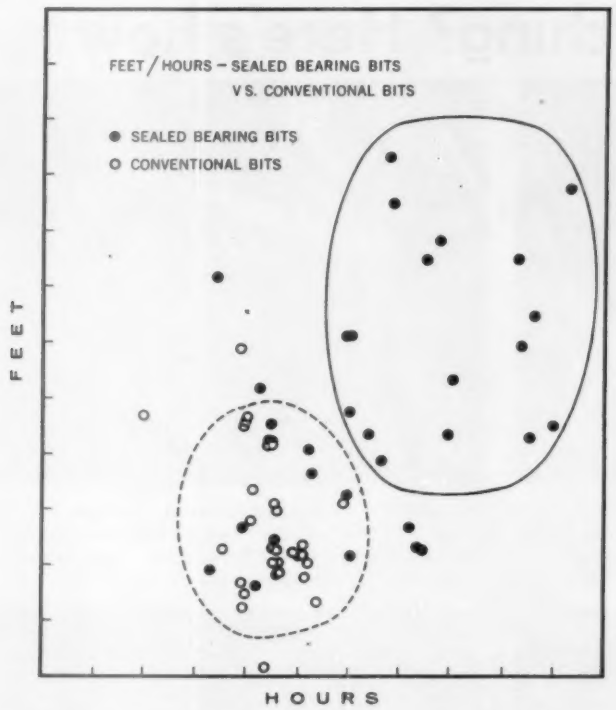
Bits with working bearing seals frequently run twice as far as similar bits without the seal, according to Hughes. In some cases the improvement has been threefold.

Thus far, the new seals have been put on 8¾-in. insert-type bits only. These are the so-called chert bits which have "buttons" of sintered tungsten carbide instead of milled chisel-shaped teeth. Hughes spokesmen say that the success of the bearing seal in the insert bits will likely result in their use in some formations presently drilled with milled-teeth bits.

Bits with a bearing seal cost 25 to 35% more than similar bits without bearing seals (approximately $1,400 vs. $1,100 for the 8¾-in. insert-type jet bit with buttons on the gage surface of the cones).

Hughes engineers say that the drilling contractor can get the extra investment back from the sealed bearing by eliminating round trips with the drill string.

More sizes later. Hughes stresses



PATTERN OF RESULTS with sealed-bearing bits indicates that, on the average, they drill more hours and more feet than do similar bits without bearing seals. The runs plotted here are for 8¾ and 7⅞-in. insert-type jet bits with inserts on the gage surface of the cones.

that bearing seals are not an immediate need for some bits. That is, in drilling many formations, teeth on the bit wear out about as soon as do the bearings. As a result, extra cost of a bearing seal might be needless.

The bearing problem has been restricted mostly to hard-formation bits. The tungsten carbide inserts on the "knobby" bits are virtually indestructible. They easily outlast any conventional bearing. Even a sealed bearing is hard taxed to run as long as the inserts.

It was for this reason that Hughes put its first bearing seal on an insert bit. The 8¾-in. size was selected because it is most popular for hard-formation drilling. Later on, the company expects to add a complete range of sizes in insert bits from 7⅞ to 12¼-in. Many of these sizes will be available before the end of the year.

When the time comes to put bearing seals in milled tooth bits, Hughes engineers speculate that medium-soft to soft-rock drilling models will be fitted first. This is because many of the softer formations are not abrasive; they wear the teeth very slowly while bearings continue to wear at a normal rate. Thus, the help of a bearing seal would mean longer life for the bits used in these formations.

End of long search. It has been obvious to drillers over the years that some of the things in mud cut short the life of their bit bearings. They have tried to separate sand by settling the mud and by other means. There appeared no way to eliminate the other causes of trouble.

So, early in the history of rotary drilling, it occurred to some that the bearings ought to be sealed. This proved difficult to do. When conventional seals failed, some tried a difficult approach—putting a "lubricator" in the drill string which would continually inject grease into the bit bearings while the bit was on bottom. Thus, with this lubricator, any grease washed out by the mud should be replaced almost immediately by grease from the lubricator.

The bit lubricator was common until some 20 years ago. At about that time, the bit manufacturers cured most of their early bearing problems by developing better metals. And, as a result, bearings didn't again become a really critical problem until recently.

The importance of long bearing life was impressed anew on drillers some 10 years ago when the first insert-type bits went to the field. Added to this is the recent trend to extra-heavy weights on the bit and long drill-collar strings; these load bearings more heavily than ever before.

First good measure. In seeking to add to bearing life, Hughes was led back to the old question of what it is that actually shortens life. The company's laboratory checked the exact effect of each of the common mud materials on bit bearings. Results of this work were reported by George King (OGJ, Nov. 16, 1959).

Bit bearings, King found, appear to last longest when run in air. This would account for the long bit runs common to air and gas drilling in the field. Next-best lubricant was oil or grease. Water was an extremely poor third; the hydrogen in ordinary tap water probably causes the bearing races to become brittle.

Ordinary mud reduced bearing life to a fraction of that in oil or grease. If the mud contained sulfide compounds, bearing life took another drastic cut.

Now knowing exactly where bearing trouble started, Hughes set about designing a seal to exclude mud from the bearing area. Five years and some 50 experimental bits later, the company was ready to announce what it calls a practical, dependable seal.

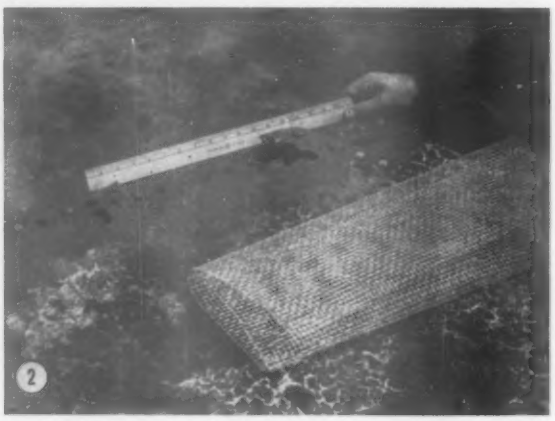
Two hundred so far. To date, Hughes has put about 200 of its production-model sealed-bearing bits into the field. The accompanying chart is a sample of the results. In only a relatively few cases has the sealed-bearing bit failed to drill enough additional feet of hole to justify its extra cost.

Drilling practice with the sealed-bearing bits is about the same as with conventional bits. Some drilling contractors have taken advantage of the sturdier bearings by running higher weights to get a faster drilling rate. Others have used their usual weights and gleaned the extra footage at about their normal drilling rate. In appearance, the sealed-bearing models are little different from similar bits without seals. Nothing of the seal shows. Thus far, Hughes has refused to divulge any of the details of the construction of the seal. Patent considerations, company officials say, make secrecy necessary for the present.

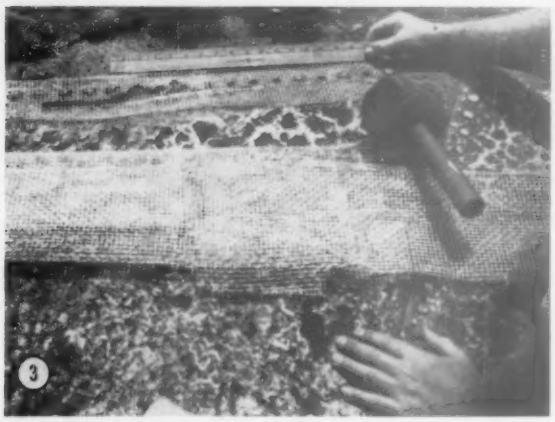
Other manufacturers are known to be working on bearing seals of their own. None has announced how long it will be in putting its designs into production.

Tanks need patching? Here's how . . .

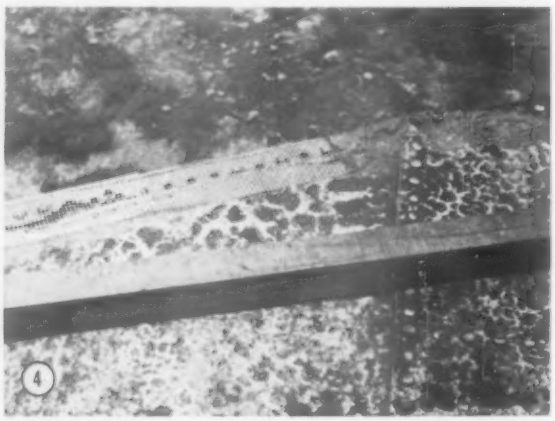
CORRODED ROOF of an oil-storage tank in Venezuela's Maracaibo area. Holes like these can cause serious evaporation losses from the stored oil. Tank surface was carefully cleaned with a wire brush and . . .



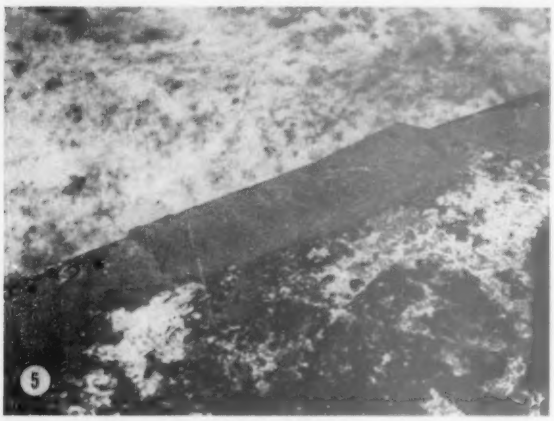
WIRE MESH was obtained to use as a support for the epoxy adhesive. Paper can be used as sole purpose is to hold adhesive in place until initial set. For small holes, no mesh is required, but for large ones . . .



MESH IS CUT to completely cover the corroded portion of the tank around the holes. A mallet helps to shape the mesh so that it will conform to the tank surface. . . .



MESH IN PLACE, epoxy adhesive is applied with trowel directly over mesh and worked through the wire and contacts metal of tank. Top surface of epoxy material is smoothed slightly and . . .



HERE'S FINISHED JOB. Patches similar to this one were put on a tank 1½ years ago, and the tank is still vaportight. Patches can be applied to tank bottoms and will prevent leaking.

CORRODED ROOFS and bottoms of oil storage tanks can be sealed at little cost with a new epoxy adhesive and filler. Material is applied with a trowel and dries to steellike hardness in 2 hours.

The epoxy adhesive, called Plastic Steel by the manufacturer, Devcon Corp., Danvers, Mass., has the consistency of clay when first applied but dries in about 2 hours to a hard tough material. Use of this material will eliminate expense of replacement of tank roofs and bottoms, will keep rain water out of the tanks, and cut down on evaporation losses.

SWANSEA HARBOUR SOUTH WALES

This ingenious new fire-fighting float, the "BP Firemaster", was designed by BP. It can deliver 3,100 gallons of water a minute at a pressure of 100 pounds per square inch, or alternatively 12,500 gallons of foam a minute.

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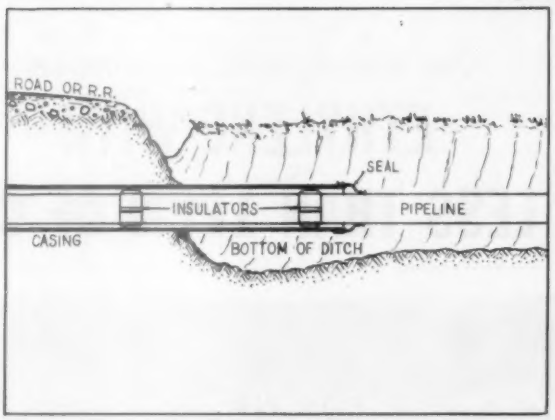
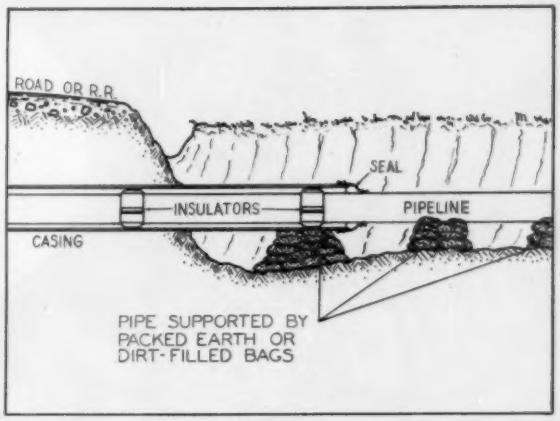
Fig. 1



Present method of filling bellhole can leave pipe unsupported, but . . .

Fig. 2



this recommended method will fully support line, and is one good way to . . .

Avoid shorts at cased crossings

BY STEVE OWENS
T. D. Williamson, Inc., Tulsa

MANY a pipeline superintendent has been asked by his corrosion department to approve a job order for $2,000 to $8,000 to investigate a shorted cased crossing.

His first thought is usually to find a less expensive way. Then the corrosion department explains what must be done and what it will cost if something isn't done—and approval of the request usually follows.

When a short develops, the insurance against leaks in the pipeline has been reduced because cathodic protection is not adequate. Besides the protection loss, the casing contacting the pipe may set up an electrolysis condition that will cause the pipe to corrode unless more cathodic protection is applied in the vicinity of the shorted casing.

You can spend from $200 to $500 to install sacrificial anodes but this must be repeated every 6 to 8 years. You may install another rectifier for about $2,000 and pay the power bill of some $15 per month.

But this raises the question: "We spent good money on what we considered to be good insulators and seals and now that the construction is over and the line is in operation, why must we still spend money on cased crossings? Did we buy the wrong kinds?"

The answer probably lies, not in the insulators and seals, but in the conditions under which they were used.

Causes of Shorted Casings

In analyzing the common causes of shorted casings, several construction hazards must be mentioned.

Hazard No. 1. First, there's the large bellhole at the end of the casing.

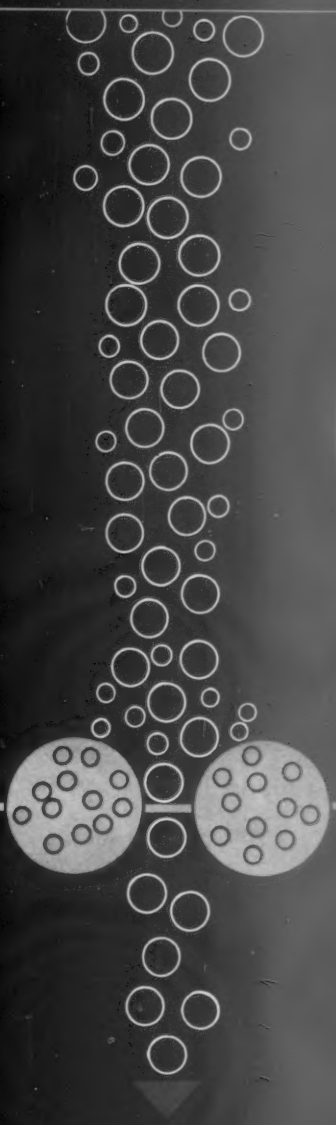
It is obvious that this big hole is necessary for the boring operation and extending the casing into position. This same large bellhole is appreciated by the tie-in crew because it gives them plenty of room for handling the drag section (that piece of pipe the insulators are used on) when it is extended through the casing. The welder has plenty of room when he makes the welds on each end of the drag section.

In fact, this large hole is ideal for everything except the insulators and seals, and very likely it makes their installation a little easier. (See Fig. 1.) Unfortunately, when the backfill dozer comes along and dumps tons of soil on top of the casing and pipe, some undesirable situations can develop.

If the pipe is unsupported for some distance beyond the casing, the overburden of soil may cause excessive pressure on the insulator at the end of casing or at least on the coating where this insulator is attached. On big-inch construction this overburden on the unsupported pipe can cause the end of the casing to become egg-shaped and distort the seal, although it was installed properly before backfilling was started.

The same overburden bears down on that part of the casing that extends into the bellhole beyond the bored hole. If this extension of casing is unsupported when covered, it can move with respect to the coated pipe and distort the seal at the end of the casing.

Considering the convenience versus the inconvenience of large bellholes at the end of cased crossings, it is easy



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This is only one of many applications which utilize the high capacity and selectivity of LINDE Molecular Sieves. In fact, Molecular Sieves not only outperform other adsorbents, but do other adsorption jobs never before accomplished. Whether in new installations or as replacement adsorbent in existing units, Molecular Sieves can help you minimize both investment and operating costs. More specifically, here's how they are used. . . .

A major petrochemical company has reduced the CO_2 content of its ethylene from 3000 PPM to less than 1PPM. This high purity is achieved in a single-stage process, automatic and non-corrosive, which has proved to be more economical than the alternative four-stage process. Other petrochemical uses include drying of cracked gases, ethylene, hydrogen, liquid propylene, solvents and many other gases and liquids. **Natural gas producers** use Molecular Sieves for drying and sweetening of natural gas, for sweetening of liquid propane and butane, and for drying of adsorber oil. **Petroleum refiners** use them to gain efficiency in drying reformer hydrogen, liquid butane LPG and transformer oil, and for removal of impurities such as CO_2 and mercaptans. **Refrigeration manufacturers** use Molecular Sieves as a desiccant in super-drying refrigerants to eliminate freeze-up and corrosion.

For these and many other adsorbent applications, you can rely on patented LINDE Molecular Sieves to perform more effectively. They are the top quality material of their kind available today, always uniform, with high capacity, high strength, and high bulk density. They are available in regular and special grades to meet your specifications.

LINDE technical know-how—gained from years of laboratory and field work with adsorption problems—can help make Molecular Sieves work profitably for you. For further information, write Dept. O-033 Linde Company, Division of Union Carbide Corporation, 30 East 42nd Street, New York 17, New York. **In Canada:** Linde Company, Division of Union Carbide Canada Limited, Toronto 7, Canada.

SOME AREAS WHERE MOLECULAR SIEVES IMPROVE ADSORPTION

- Purification of ethylene
- Drying gases, liquids, solvents
- Drying, sweetening natural gas
- Sweetening liquid propane, butane
- Drying jet fuels
- Octane improvement
- As refrigerant desiccant
- Controlled atmosphere purification

LINDE COMPANY

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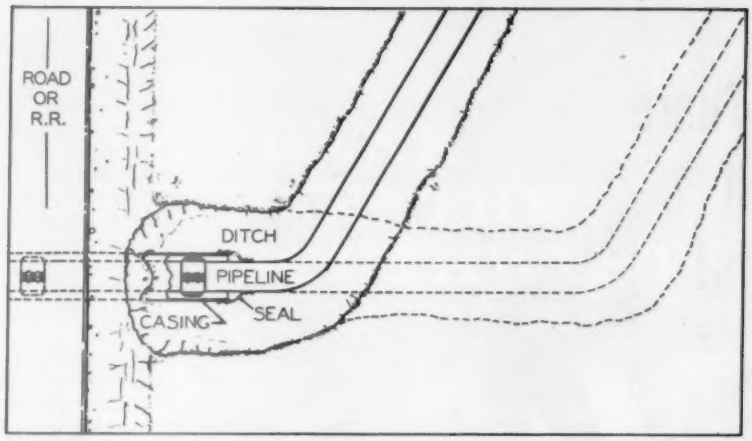
UNION CARBIDE



BY MAKING BEND too close to a cased crossing, as shown above, stresses can damage seal, causing shorts. Recommended method is shown by dotted lines, beginning the bend a safe distance from the crossing where possible. Fig. 3.

to decide in favor of having them oversized. This does not mean we must ignore the troubles they cause. The construction specifications should require supports of compacted dirt or sacks of dirt at proper intervals and places to prevent movement of pipe or casing during backfilling. (Fig. 2.)

Hazard No. 2. Side, sag, or overbends close to the cased crossings are a potential hazard to insulators and seals. (See Fig. 3.) Such bends make the lineup more difficult for the tie-in welds on the drag section. When such trouble is experienced, the drag section is usually left with more than normal pressure against the casing end. When ambient temperature changes occur, expansion and contraction of the pipeline may increase the pressure.

Under such conditions, the seal could be damaged or the casing shorted regardless of the type of insulators and seals used. Such conditions could be minimized by keeping bends a safe distance away from casings where the right-of-way conditions will permit. (See Fig. 3.)

In recent years pipeline construction has been based more and more on sound engineering. These are some of the problems that should be considered in the engineering plans of a pipeline.

Alaska gets its first crude line

• Marine tanker-loading terminal to accommodate tankers up to 28,000 dw. tons will be constructed.

ALASKA'S first crude-oil pipeline, linking Swanson River and Soldotna Creek fields to a marine tanker-loading terminal at Nikiski, on Cook Inlet, will be operated remotely from Nikiski.

Kenai Pipe Line Co., an affiliate of Standard Oil Co. of California, will construct the 6 and 8-in. common-carrier pipeline (OGJ, April 11, p. 93).

The system will consist of a 3-mile 6-in. feeder line from Swanson River feeder station to the original pump station located near Soldotna Creek, and a 20-mile 8-in. trunk line from there to Nikiski. Other feeder points may be added later.

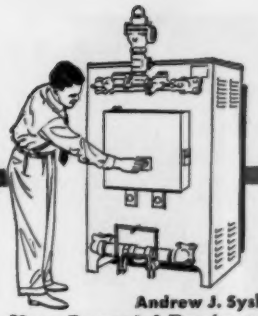
Pump station. The initial trunk-line station will consist of the following elements:

Two 13,000-bbl. cone-roof tanks equipped with propeller-type mixers. Tankage will provide for shutdown of the trunk pipeline and will provide gaging of the oil into the pipeline and as received from the field. The mixers are required to break up the wax crystals in the oil so that it will be less likely to solidify in the pipeline.

Engine-driven reciprocating pumps will be designed to develop 1,000-psi. discharge pressure.

There will also be an office, gagers' laboratory, and quarters for emergency maintenance and operating personnel at Soldotna Creek.

Remote supervisory-control equip-



Andrew J. Syska,
Hayes Research & Development Engineer Reports . . .

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locates pipeline holidays and electrical contacts underground

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This completely transistorized unit finds trouble spots underground without the necessity of uncovering the pipe. Working in tandem, a two man crew can inspect an entire line, locating coating breaks, contacts with other lines and mapping the entire line.

The TR Underground Holiday Detector operates on a 12 volt automobile battery. It generates a 15 watt, 750 cycle, stable A.C. audio-frequency signal on a pipeline. Two 750 cycle resonate filters in the receiver reject unwanted signals.

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ment and radio communication facilities will be installed to permit remote operation of the station from Nikiski.

Trunk line. The trunk pipeline from the field to Nikiski will be buried with 3 ft. of cover to provide thermal insulation from winter weather and thus maintain the oil temperature as high as possible. Pipe will be coated and wrapped to minimize external corrosion.

The line will be designed for initial maximum operating pressure of 1,000 psi.

An 8-in. line was planned for two reasons: It will provide reserve capacity to handle additional production that is expected to be developed. At times the pipeline will have to operate at temperatures below the pour point of the oil, and an 8-in. line is much less susceptible to plugging than a 6-in.

Marine terminal. The marine terminal will consist of tankage, loading lines, ballast-handling facilities, office, laboratory, and miscellaneous pumping and heating facilities.

Originally, two 132,000-bbl. cone-roof tanks will be installed (48 ft. high by 140 ft. in diameter). This will provide tankage for one T-2 tanker load of 115,000 bbl. plus adequate reserve storage.

Crude oil will be loaded aboard tankers by gravity at an average rate of 15,000 bbl. per hour through a 24-in. loading line from the tanks to the end of the wharf and three 8-in. hoses connecting to the tanker.

Loading operations will be performed from the office, where all necessary instrumentation will be located. The initial pump station also will be controlled from the office, which is combined with the laboratory, emergency quarters, and garage.

The wharf will be located in 40 ft. of water with the deck 36 ft. above the mean low-water level and will be designed to accommodate tankers up to 28,000 dw. tons. Tankers will berth on the outside face of the wharf, which will be designed for ice and maximum currents expected at this location.

The causeway will have a 12-ft.-wide roadway and a 6-ft.-wide pipe way.

The breasting platform will be 50 ft. wide by 270 ft. long; it will consist of a reinforced concrete deck supported at each end by earth-filled sheet-pile cells and by steel piles between these cells.

The main mooring dolphins will be designed for a rope load of 228,000 lb. and the secondary mooring dolphins for a rope load of 114,000 lb.

Why do oil men call ours the Oil Bank of the Southwest? Every member of our Oil and Gas Department was an oil man *before* he became a banker and that goes for a large number of our directors and advisory committee, too! We understand the problems of the explorer, producer, researcher, refiner, transporter, wholesaler and retailer. It will be a pleasure to serve you.

Photo: Harold Vance (right), Vice President and Manager, Oil and Gas Department, and Petroleum Engineer E. Ralph Daniel, inspect a compressor plant in the Sarah White Field, Galveston County, Texas.

MEMBER F.D.I.C.

Bank of the Southwest
NATIONAL ASSOCIATION, HOUSTON

The Arithmetic of Materials Handling

Fuller pneumatically conveys drilling mud directly into oil rig bins, from specially-fitted Bourg Mud & Chemical Co. supply ship. Ship carries 250 tons of mud, delivers at a rate of 50 tons an hour.

Sea-Going Fuller Pneumatic Conveying System Cuts Time and Cost of Vital Drilling Mud Deliveries

The Bourg Mud & Chemical Co., Inc., of Lockport, La., is making off-shore deliveries of drilling mud by advanced Fuller pneumatic systems.

The dry mud is automatically pumped aboard oil rigs from a Fuller equipped cargo ship at a rate of 50 tons an hour—one man replacing large crews handling 100-pound sacks in cargo nets. Previously, bag handling in high seas had been either dangerous or impossible. The highly flexible bulk-handling system now operates safely and efficiently at all times.

Self-emptying hoppers designed and built by Delta Tank Manufacturing Company installed into the Bourg ship are fitted with F-H Airslide® fluidizing gravity conveyors. A 6-inch Fuller-Kinyon pump transfers the aerated material to bins aboard the rig—over distances up to 300 feet. Air pressure is supplied by a diesel-driven Fuller single-stage vane-type rotary compressor.

Here is a good example of Fuller's engineering experience and wide range of equipment combining to solve your materials handling problem. If you handle large volumes of dry bulk granular materials, why not investigate a simple, efficient Fuller pneumatic conveying system? For details, write or call Fuller today outlining your problem.

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▶ ▶ ▶ New Equipment Section

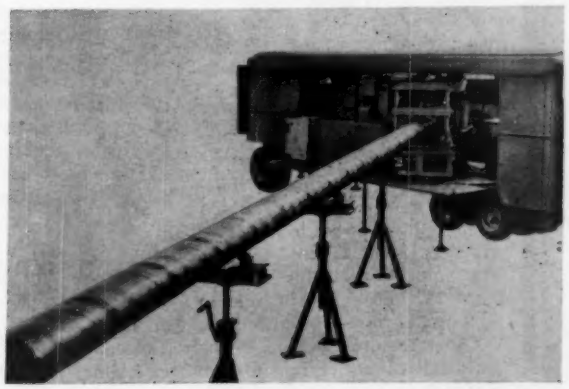
This week's SHOWCASE features . . .

Trailer-mounted portable pipe mill

PIPE MILL comes in eight sizes to fabricate pipe and tubes with diameters from ½ through 120 in. and wall thicknesses from 22 gage through 1¼ in. Weight ranges from 3 ton for the smallest to 55 ton for the heaviest machine. Machines to fabricate pipe with diameters to 28 in. can be mounted in one trailer; machines for larger pipe can be mounted in twin trailers.

The Driam machine forms hot-rolled strips into tubes and welds the strip edges simultaneously inside and outside. Only two men are required to operate a machine making pipe up to 16 in., three are required for a machine making pipe up to 28 in., and four are required for a machine making larger diameters.

The only departure of the pipe from API standards, according to the manufacturer, is the weld seam. It is spiral instead of longitudinal. Sources: **Driam Div. of David Douglas & Co., Inc., Manitowoc, Wis.**



PIPE MACHINE forms hot-rolled strip into tubes, welds edges simultaneously inside and out.

Quintuplex plunger-type pump

. . . now available has been developed for well servicing. Features include reduction to one-half the size of comparable pumps, a 5,000-lb. weight, and elimination of 66% of the customary surge, according to the manufacturer.

The F-400 pump measures 46½ by 54 in. and is rated at 450 hp. Two pumps can be mounted back to back on a truck and still come within the 8-ft. road limit. Other features include a removable, one-piece cylinder head and stuffing boxes. The pump has a 2½-in. discharge and 3, 3½, and 4-in. plungers. Maximum pressures range from 6,000 psi. at 100 r.p.m. with a 4-in. plunger up to 10,000 psi. at 100 r.p.m. with a 3-in. plunger. Maximum speed is 600 r.p.m. Source: **Frank Wheatley Pump and Valve Mfr., 520 South Thirty-third West Avenue, Tulsa.**

●

Filled-Teflon piston rings

. . . now being marketed are ideal for nonlubricated service to seal reciprocating, oscillating, and rotary motion of both external and internal cylindrical surfaces against leakage of liquids or gases, according to the manufacturer. The piston rings are said to have

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exceptional thermal stability and are suitable for continuous service at temperatures from −420° to 500° F. They are available in many designs. Source: **Garlock Packing Co., 444 Main Street, Palmyra, N. Y.**

●

Circulating valve

. . . being produced now is wireline-operated and allows communication to be established or shut off in a tubing string, the maker claims. Using an internal sliding-sleeve design with the sleeve traveling in a one-piece body, the collet-type valve features all sealing in one plane, eliminating the possibility of pressure lock or pressure shifting, the maker says. For added safety, all screwed joints have triple seals with tapered threads. The value is available in sizes from 1¼ through 4 in. and in all popular thread connections.

Other features include O-ring seals that cannot entrain foreign material or have lip failures or cup reversals. Source: **Garrett Oil Tools, Div. of U. S. Industries, Inc., Box 2427, Longview, Tex.**

Four new business-plane models

. . . have been disclosed. The Model 500A is powered by two 260-hp. fuel-injection engines, cruises at 220 m.p.h. at 70% power, and has a range of 1,420 miles at 45% power. The Model 500B is powered by twin 290-hp. fuel-injection engines, cruises at 225 m.p.h. at 70% power, and has a range of 1,250 miles at 55% power. Model 560 is powered by 350-hp. fuel-injection engines, cruises at 234 m.p.h., and has a range of 1,500 miles on a normal fuel capacity of 223 gal. The Model 680F is powered by twin 360-hp. fuel-injection engines, and cruises at 255 m.p.h. Source: **Aero Design & Engineering Co., Bethany, Okla.**

Gas drilling

. . . aided by chemical which serves as an antiballing agent and as a lubricant. Tradenamed Nuodex 963, the product is a fine, powdered chemical. Each pound has about 200,000 sq. in. of water-repelling surface area to counteract the water influx problem in air and gas drilling, the maker says. It is added to the air stream in concentrations of 2-5% of cutting weight.

According to the maker, it aids air drilling four ways, by "waterproofing" bit cuttings to prevent balling, reducing torque, reducing wear on the stripper rubber, and reducing caking in blow lines. Source: **Nuodex Products Co., Div. of Heyden Newport Chemical Corp., Elizabeth, N. J.**

Cooper Skytop is tops in performance.

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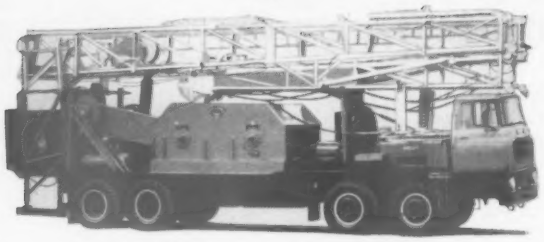


Typical Cooper servicing and workover unit with Skytop Derrick. DIAMOND Roller Chains deliver power for servicing to 14,000 ft.—for workover to 12,000 ft.

Relay protects

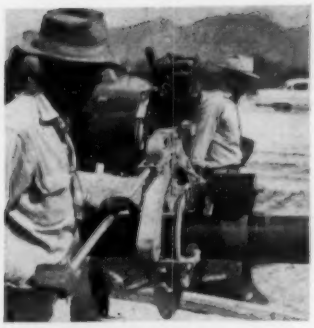
. . . three-phase motors from damage due to excessive shaft load, including locked rotor, and low or unbalanced voltages, including single-phase. The thermal synthesis relay combines heating effects of positive and negative sequence currents, in weighted fashion, to provide protection.

An automatic derating feature of the relay permits maximum use of a motor under all conditions, the maker claims, and the relay is said to be more accurate than a combination of overcurrent (indication or thermal), phase-balance, and negative-sequence relays. Source: **Applied Research Associates of Texas, Inc., 6541 North Lamar, Austin, Tex.**

•

Fishing tool

. . . combines a magnetic fishing tool with a built-in boot basket, eliminating the need to rent a separate boot basket. Suited for cleaning up hole for coring, the tool is designed for catching cones or bearings that have been sidetracked and are lodged in the annulus of the mill bore. The tool has an API regular pinup. The magnetic plug fits loose in the bottom skirt of the tool; water courses on the outside of the magnetic plug but inside of the bottom skirt. The tool comes in sizes from 1⅞ to 11 in. Source: **World Oil Tool Co., 628 Wichita National Bank Building, Wichita Falls, Tex.**



Pipe wrap tape

. . . of polyethylene, designated Permacel 308 and 12.5 mils thick, is specifically engineered as an underground pipe covering and is fully conformable to pipe joints, unions, corners, ells, and tees, as well as in straight-line wrapping, the maker claims. Its positive adhesive holding action reportedly provides a complete seal against moisture and corrosion.

It reportedly performs well over a temperature range from −30° to 180° F. pipe temperature and remains flexible at extremely cold temperatures. It can be put on by automatic pipe-wrapping machines whether manual or power-operated. Source: **Permacel, New Brunswick, N. J.**

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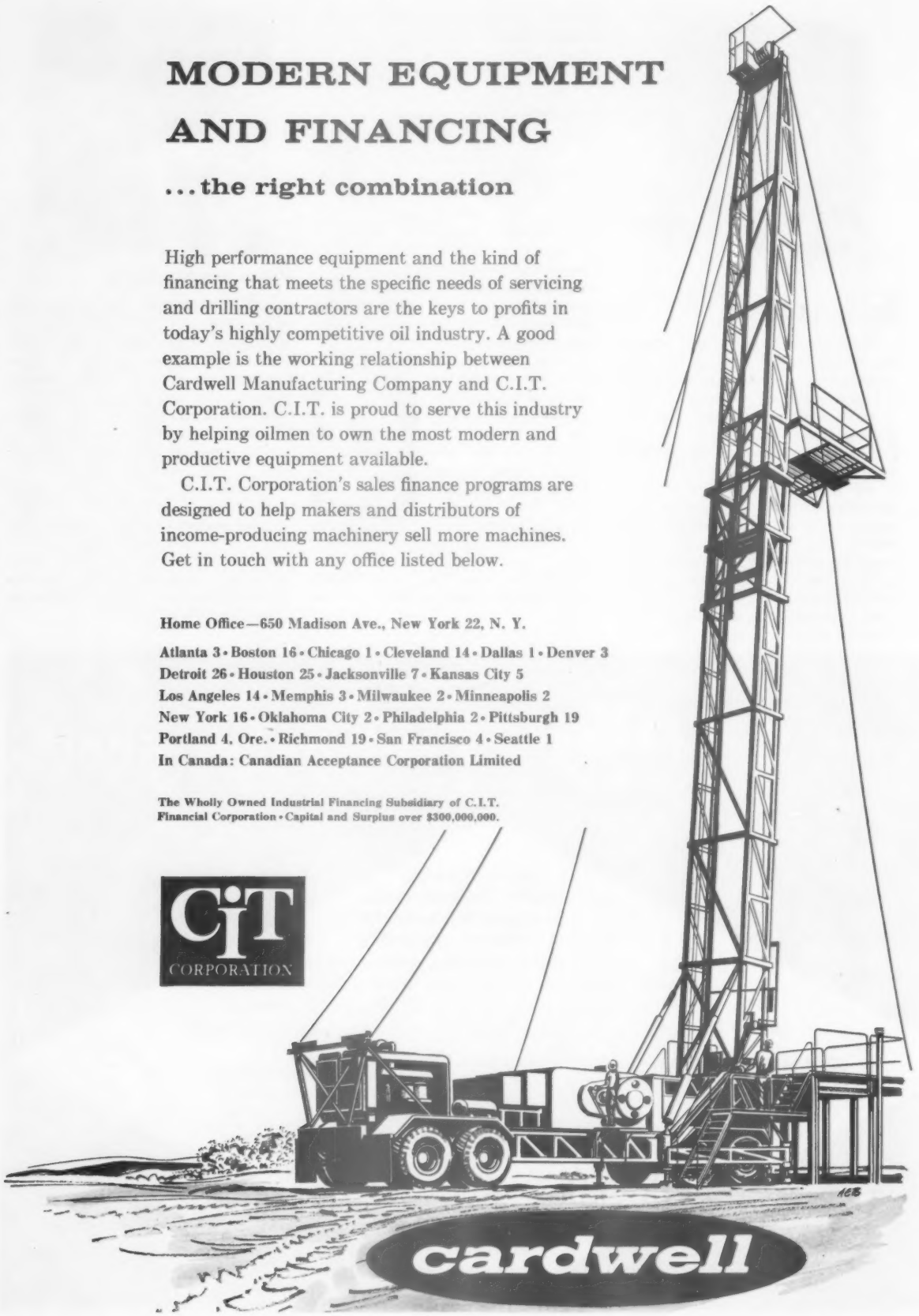

Chromatograph

. . . gas-sampling valve promises to solve the problem of getting gas samples with reproducible volumes. A handle controls two mechanically linked four-way valves with eight ports. Two ports are the inlet and outlet for the sample gas, two are for the chromatographic carrier, and the others connect with two loops of stainless-steel tubing, in which reproducible volumes of the sample are automatically isolated. Source: **Fisher Scientific Co., 449 Fisher Building, Pittsburgh 19.**

•

New oil-well fracturing tool

. . . improves production 30 to 100 times, the maker claims. The electric wire-line tool, tradenamed a Frac-Notch cutter, uses a new jet cutting process to form a circular notch horizontally around the circumference of the well bore. According to the maker, it cuts through casing, cement, and into the formation as much as 12 in. deep outside the casing, making a notch about 20 to 30 in. in diameter. Tools are available for 4½ through 7-in. casing. Maximum operating depth is 12,000 ft., and maximum operating temperature is 300° F. Source: **McCullough Tool Co., 5820 South Alameda, Los Angeles 58.**

•

Synthetic primer

. . . for hot coal-tar enamels just announced, called Reilly Redhead, features a translucent red color that permits visual detection of any areas missed in cleaning, any areas not covered by the quick-drying primer, and any areas not covered by the enamel. Initial bond strengths of up to several times those of typical nonsynthetic primers are claimed. Prices range from about $6.50 for a 1-gal. can to $5.35 per gallon for a 55-gal. drum. Source: **Reilly Tar & Chemical Corp., 1615 Merchants Bank Building, Indianapolis.**

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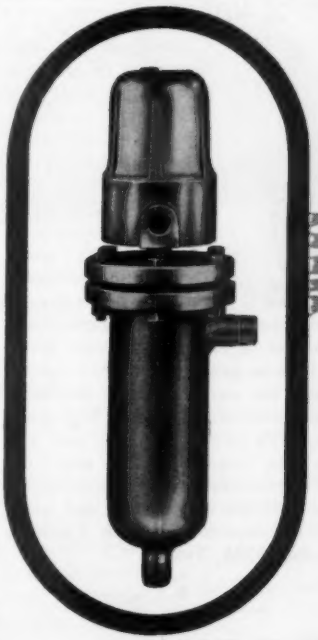

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Boiler safety device

. . . combines float action and electrode-operated functions in a common water chamber. The Levalarm EA-100P can be used to provide fuel cutout and low alarm or dual fuel cutout, or dual fuel cutout and low alarm. Float action operates a switch that is thrown open or closed through the medium of a permanent magnet and special armature. One or two electrodes at the opposite end of the level alarm body serve to release fuel cutout or actuate alarms. The device can be used on boiler working-steam pressures to 350 psi. or 650 psi. in tank service. Source: **Reliance Gauge Column Co., 5902 Carnegie Avenue, Cleveland 3.**

•

Miniature-size control valve

. . . designed for low flow rates in research laboratories and pilot plants now available provides accurate control in a variety of services such as pH control, and control of minute quantities of additives, harsh alkalies, and corrosive acids. The valve is suited for extremely low temperatures as well as higher temperatures involving liquids, gases, and molten metals. In fact, the maker reports the valve can be used anywhere that high pressures, high pressure drops, and low flows are required. The miniature diaphragm control valve is individually made to fit the user's needs and specifications. Source: **Research Controls, Inc., Box 5035, Tulsa.**

•

System monitors

. . . temperature or pressure. The digital readout system for industrial monitoring reads out from resistance temperature bulbs in the 0°-1,400° F. range and from resistance pressure transducers ranging 0-10,000 psi.

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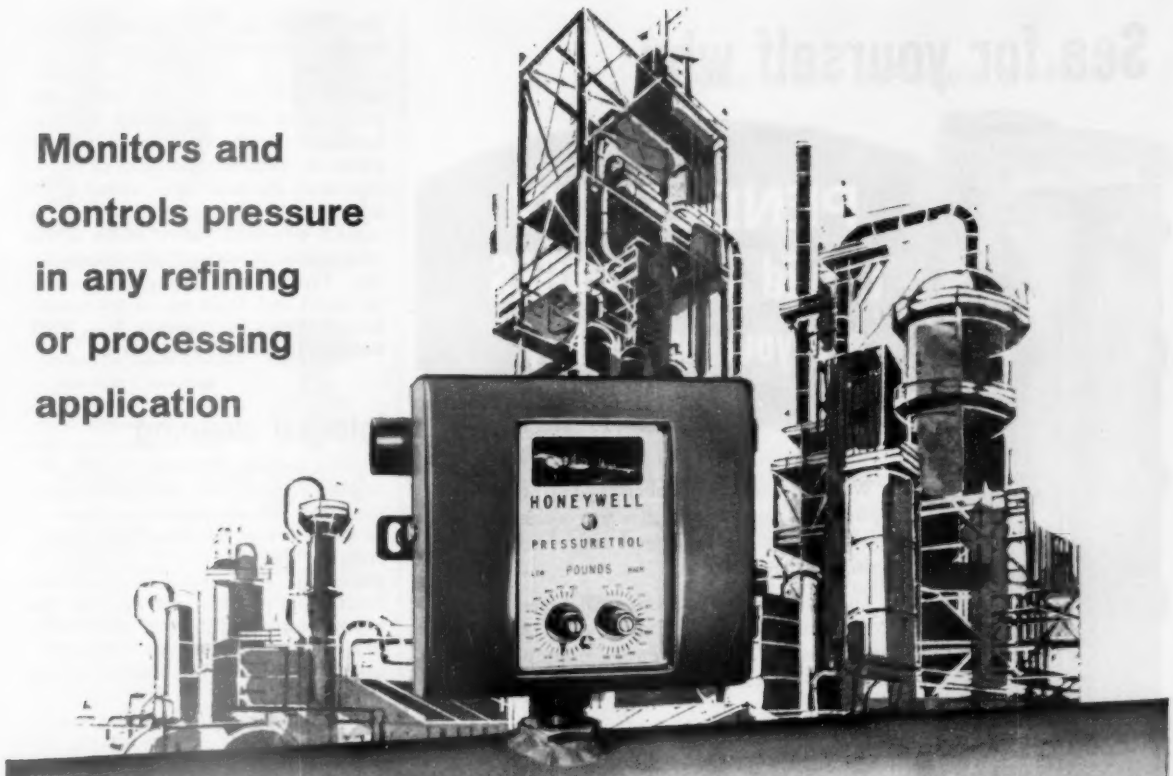

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- **FM, UL, FIA approved**

Honeywell Pressuretrols precisely measure and control pressures of any fluid, gas or steam. They can be used to sound an alarm or control a valve, pump or compressor. These are heavy duty devices designed specifically for industrial use.

The Pressuretrol can be flush or surface-mounted on a panel, or installed directly on a pipe. Settings are made with one high and one low pressure knob conveniently located on face of the unit. The mercury switch can be easily seen through a protective glass window. Depending upon pressure range, bronze, stainless steel and beryllium copper Bourdon tubes are available. Choice of control to make on pressure rise or fall.

Model P428		Model P444	
Range (psi)	Maximum (psi)	Range (psi)	Maximum (psi)
30—300	375	20" vac—40	75
50—600	750	1—20	50
100—1000	1200	5—50	80
200—2000	2400	5—150	200
300—3000	2500		

No matter what your pressure-control need, Honeywell can supply it for you. Call your local Honeywell office or write Honeywell, Dept. OJ-5-41, Minneapolis 8, Minnesota. In Canada, write Honeywell Ltd., Seaside, Toronto 17.

See us in Sweet's 1960 Product Design File, Section 5b-Min.

*Trademark

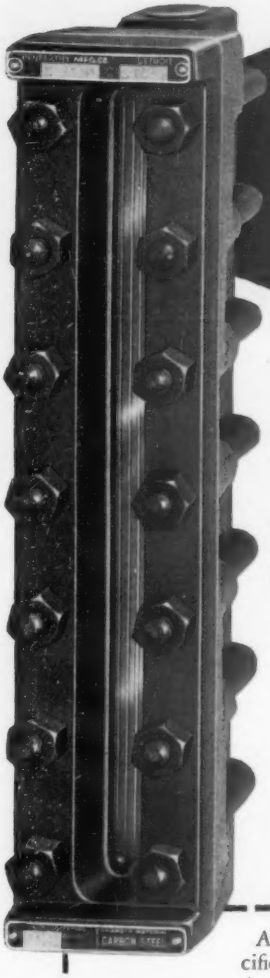
Honeywell

First in Control

SINCE 1885

75th YEAR — ENGINEERING THE FUTURE

See for yourself why



PENBERTHY Liquid Level GAGES are your better buy

Without a doubt, Penberthy direct reading liquid level gages always give you a clear, accurate picture of the fluid level and/or color and density of the media.

They are available in a variety of materials and engineered designs to meet your specific requirements . . . corrosive conditions, pressures and temperatures.

REFLEX TYPE . . .
3 pressure groups to 3600 psig. Lengths to 12 ft. Liquid shows black.

TRANSPARENT TYPE . . .
4 pressure groups to 10,000 psig. Lengths to 12 ft. Shows color, density and media.

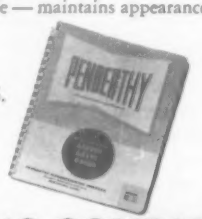
SPECIAL SERVICE TYPES . . .
High pressure, Frost-Proof, Heating Tube and Heating Chamber, Welding Pad, Large Chamber and Inclined Gages, Explosion-proof Illuminator.

All materials exceed ASTM, ASME and API specifications. Experienced design, exclusive features, selected drop-forged steel, heat-treating, accurate machining, Pyrex glass and accurate assembly assure long, trouble-free service.

Among other advantages . . .

- Perfect alignment of frame with glass and gasket minimizes leaks or glass breakage.
- Cover completely encloses sides and ends of glass and gasket preventing "blowouts."
- "Raised Face" makes cleaning and glass or gasket replacement easy — *without removing assembly from vessel.*
- Corrosion-resisting paint extends service life — maintains appearance.

Get the facts by writing for Catalog 36. Your inquiry will receive prompt personal attention.



PENBERTHY MANUFACTURING COMPANY
Division of Buffalo-Eclipse Corporation
PROPHETSTOWN, ILLINOIS

The system reads out combinations both of temperature and pressure.

Capable of accuracy in the magnitude of ½ to 2% absolute, the system promises to offer significant cost reduction through the use of copper wiring to transducers instead of more-expensive thermocouple wiring. Besides local readout, the system is capable of remote interrogation as the information is encoded for telemetering. Temperature and pressure may be monitored from up to 99 points. Source: **Texas Instruments, Inc., 3609 Buffalo Speedway, Houston 6.**

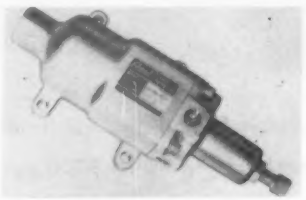
●

Internal cleaning

. . . and coating machine recently developed requires only two basic cleaning heads for all pipe sizes from 16 to 36 in. From a central push-button console, the operator controls all phases of the machine's operation. Electrically powered, the machine has a retractable brush unit that minimizes pipe-entry damage and a continuously operating vacuum pickup system that removes rust and scale during cleaning and coating operations.

An airless type of coating spray system uses hydrostatic pressure to atomize paint. The machine comes complete with pipe-handling and spinning rack and requires a minimum crew of four men. It can be moved easily from one job site to another, or it can be permanently installed. Source: **Crose Perrault Equipment Corp., 2765 Dawson Road, Tulsa.**

●



Vibration monitored

. . . by valve, which is adaptable to engines, compressors, fans, motors, or other rotating reciprocating equipment. It can be used as a two or three-way, snap-acting, nonoverlap vibration-monitoring valve on pneumatic or hydraulic-control systems to 80 psi.

The Model 2900 valve can be used as an accessory to the maker's basic controls or used alone to energize auxiliary devices. It is sensitive to vibration from any direction in the plane perpendicular to its longitudinal axis. Sensitivity is manually adjusted. Source: **Amot Controls, Corp., Box 1707, Richmond, Calif.**

3 Reasons Why

Robbins VALVES Are the Most Economical You Can Buy

1. The only valves that can be completely serviced in less than 1 minute from the front of mounting panel without removing the valve from the line!

To service a Robbins Metering & Shut-Off Valve it is only necessary to remove the handle, loosen locknut and remove barrel assembly . . . all accomplished from the front of the panel . . . no need to disturb the line connections!

2. Single barrel assembly!

For both civilian and military installations the single barrel assembly design and construction features (barrel, spindle, spindle seals, barrel seals and seat in one unit, cleaned, lubricated, sealed for oxygen service) mean practically instantaneous renewal of service without disconnecting any plumbing.

3. As many as 5000 cycles before requiring servicing!

Many Robbins Metering Valves . . . in constant use on an 8-hour a day basis for three years . . . have never required servicing, lubrication, or any parts replaced!

...And the Most Reliable!

Precision made and tested. Design capabilities, manufacturing procedures, and quality control operations at Robbins Aviation are all directed toward one objective . . . to produce a valve of the highest quality that will provide the user with the greatest reliability and the greatest economy over many years of service.

All Valves LOX Cleaned and Packaged . . . Ready for Instant Use

ROBBINS valves

Metering
Shut-Off
Oxygen
Hydraulic
Pneumatic

HI-VACUUM TO 12,000 PSI

Angle • Globe • Three-Port • Manifold

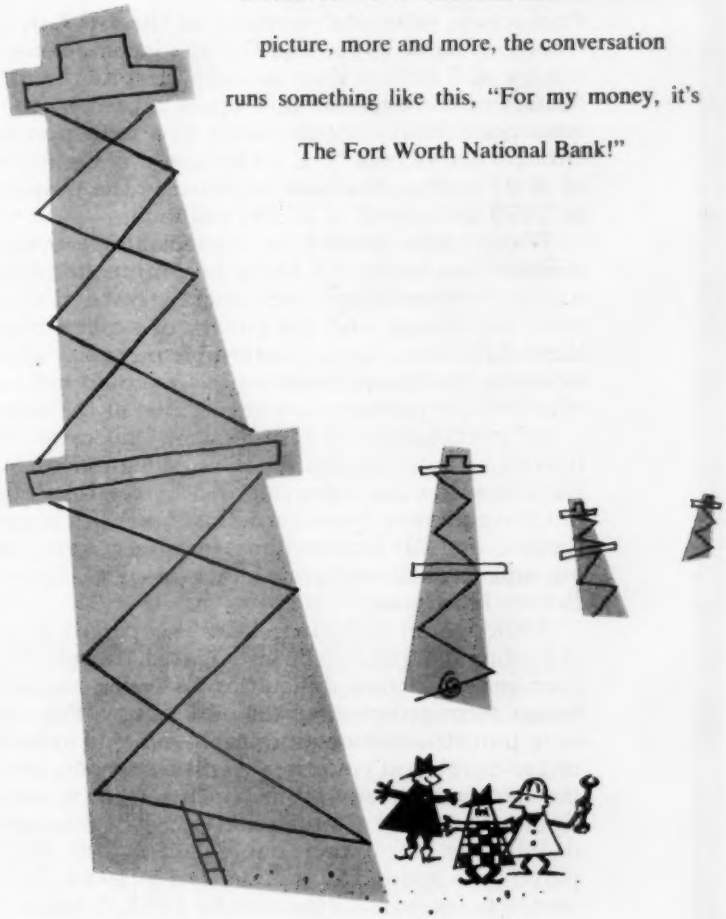
ROBBINS Aviation, Inc.

Write today for complete color catalog and valve technical information

2350 E. 38th St., Los Angeles 58, Calif.
LUdlow 9-5221

"wherever oil men gather"

For every oil man out in the far-flung fields there are several others backing him up in the many urban centers of oil activity. That's why when oil men get together, their conversation usually runs from the mundane to the urbane. And when financial matters enter the picture, more and more, the conversation runs something like this, "For my money, it's The Fort Worth National Bank!"



THE FORT WORTH NATIONAL BANK

Helping Build a Greater Fort Worth and Southwest

MEMBER FEDERAL DEPOSIT INSURANCE CORPORATION
CAPITAL AND RESERVE ACCOUNTS OVER $20 MILLION

Report for 1959

The British Petroleum Company

Production, sales and earnings of the BP Group were all slightly above the record levels of 1958. The Group's income before taxation was £131 million, less by £7 million than in 1958, despite the increase in sales tonnage—a reflection of the depression in prices caused by the strongly competitive market conditions. Nevertheless, owing to a reduction in the charge for taxation, the Group's net income of £63 million was slightly higher than last year's. A total of £97 million has been retained in the business. Total capital expenditures in 1959 amounted to £141 million.

While 1959 showed an appreciable recovery in the rate of expansion of demand, the industry is likely to continue to experience difficulties due to oversupply. Various factors, including the restriction of imports into the U.S., exports from the Sahara, and the growth of exports from Russia, tend to concentrate these difficulties in the Eastern Hemisphere, where the BP Group has its main interests. In these circumstances it should not be expected that the growth of Middle East production will continue at the same high rate as the last decade.

BP's arrangements with Sinclair Oil Corporation should prove of long-term benefit to both companies. The development of the business of Sinclair and BP Sales, Inc. has been retarded by the restriction on imports into the U.S.A. but the company has secured business with a number of import quota holders. Sinclair and BP Explorations, Inc. investigated production prospects in Colombia and work is continuing. A geological survey also has been completed in British Honduras.

Although an increase in sales is expected during 1960, no material increase in trading margins can be anticipated, though the Group is effecting operational economies. Current difficulties, however, should not obscure the encouraging longer term prospects of the oil industry. Population growth, economic expansion, industrialization, and improvements in living standards—particularly in under-developed countries—will be accompanied by a continuing increase in the demand for energy in which oil has a major role to play. The O.E.E.C. Energy Advisory Commission recently forecast for Western Europe a 1965 demand for oil products equivalent to 200-240 million tons of crude oil, compared with about 157 million tons in 1959. Total free world oil demand is expected to increase 35 per cent by 1965. Granted freedom of international trade, the oil industry should therefore continue to enjoy confidence as a growth industry and the Group is well placed to participate in this growth.

THE BRITISH PETROLEUM COMPANY

BP GROUP INCOME STATEMENT

FOR THE YEAR ENDED 31st DECEMBER

	1959	1958
Sales Proceeds	£860,039,000	£829,294,000
Deduct: Sales Taxes, Customs and Excise Duties, etc.	247,924,000	231,009,000
Net Sales	612,115,000	598,285,000
Dividends and Other Income	15,361,000	17,567,000
	627,476,000	615,852,000
Cost of Oil, Operating, Selling and Administration Expenses	444,232,000	423,424,000
Depreciation and Amounts Written Off	46,554,000	48,533,000
Interest Payable	5,732,000	5,952,000
	496,518,000	477,909,000
Income Before Taxation	130,958,000	137,943,000
Taxation	67,498,000	74,758,000
	63,460,000	63,185,000
Income applicable to Minority Shareholders	102,000	233,000
Net Income	£63,358,000	£62,952,000
Attributable to:		
Consolidated Companies	62,149,000	61,923,000
Non-Consolidated Companies	1,209,000	1,029,000
	£63,358,000	£62,952,000

SALES

While total sales of crude oil and refined products were approximately 65 million tons, an increase of 3 million tons (4 per cent) over 1958, inland product sales rose nearly 10 per cent, thus confirming the trend to cover a greater proportion of product sales through the Group's own marketing organizations.

PRODUCTION

The Group's principal sources of production continue to be Kuwait, Iran, Iraq and Qatar. Nigeria, where crude output more than doubled in 1959, can now be regarded as an oil producing country. The Group is half-owner of the Nigerian producing company. The Group also has production interests in the United Kingdom, Canada, Egypt and in Trinidad, where production again increased.

REFINERIES

The total quantity of crude oil refined for the Group in all refineries was just under 780,000 barrels a day in 1959. Several existing refineries were expanded, one new one was commissioned and two others (one in Montreal) are to be commissioned in 1960. In addition the Group has interests in refineries under active consideration, planned or being built in New Zealand, Turkey, Africa, France and Northern Ireland. The Group's operations in petrochemicals were again increased in 1959. The Sunbury Research Centre was also active in this and other fields.

TANKERS

Because of the world surplus of tanker tonnage, the Group has spread out deliveries of tankers on order. At the end of 1959, the Group's tanker fleet consisted of 144 ships of 2,644,000 dead weight tons—fewer ships but more tonnage than in 1958. In addition, the Group has 2,800,000 dead weight tons on charter, slightly less than in 1958.

DIVIDENDS

The Directors have recommended a final dividend on the ordinary stock of one shilling and six pence per £1 unit of stock, free of United Kingdom income tax, making a total for the year of two shillings and two pence per £1 unit of stock, free of U.K. income tax. The Annual General Meeting will be held in London on May 19, 1960.

LIMITED BP BRITANNIC HOUSE · FINSBURY CIRCUS LONDON · E. C. 2 BP

SHOWCASE . . .

New Literature

Low-voltage

. . . equipment is described in a new 84-page buy log (GEC-1100B), available now upon request. It covers service entrance equipment, light and heavy-duty switches, tumbler and open-knife switches, hinged wireway, circuit breakers, switchboards, motor-control centers, sectional distribution centers, and various types of panelboards and busway. The buy log is designed so that application, selection, pricing, and ordering information can be found quickly and easily. Source: **General Electric Co., Plainville, Conn.**

Fittings catalog

. . . outlines Tubend (fittings conforming to ASA B16.9), stainless-steel, and aluminum welding fittings. Catalog 599 lists elbows, returns, tees, reducers, and caps. It includes specifications for carbon steel and ferretic-alloy materials, permissible raw materials for wrought-austenitic stainless-steel welding fittings and materials, wrought-aluminum alloys, and selected ASTM specifications for low-temperature service. Source: **B.K.L. Alloys, Ltd., Birmingham Factory Centre, Birmingham 30, England.**

Turbocharged

. . . gas engine designed as a compact high-horsepower driver for centrifugal pipeline compressors, generators, and liquid pumps is discussed in 28-page Bulletin 176. The Model TPV is a 2-cycle, V-type engine. Source: **Clark Bros. Co., P. O. Box 560, Olean, N. Y.**

Redox

. . . pH and oxidation-reduction electrodes, and electrode mountings are detailed in a new four-page data sheet. Two tables in Data Sheet NSS (1) aid in selecting the type of electrode and mounting needed. Source: **Leeds & Northrup Co., 4934 Stenton Avenue, Philadelphia 44.**

"How to Bend Conduit"

. . . is the title of a 12-page booklet furnishing complete instructions on how to make precision bends in electrical-metallic tubing, rigid steel, and rigid-aluminum conduit. It describes five fundamental bends and illustrates the proper technique in the art and practice for on-the-spot bending of small conduits. Source: **Appleton Electric Co., 1701-1759 Wellington Avenue, Chicago 13.**

"Products for the Plant" booklet

. . . covers conventional reciprocating, axial-flow, and centrifugal air compressors, centrifugal pumps, steam condensers, steam-jet ejectors, vacuum pumps, air hoists, and air and electric tools. Eight-page Form 223 shows representative machines in each product type and gives size, capacity ranges, and recommended applications. Source: **Ingersoll-Rand Co., 11 Broadway, New York City 4.**

Welding

. . . specifications list provides technical details of 34 different rods and 18 types of flux which comprise the Sifbronze oxyacetylene welding range. The 24-page handbook shows the type of work for which each rod and flux is designed, mechanical and physical properties, and method of use. Source: **Suffolk Iron Foundry (1920), Ltd., Stowmarket, Suffolk, England.**

Specialty tools

. . . for wire-line service are illustrated in a new bulletin now available. Tools include indicators and depthometers, surface accessory equipment, surface safety equipment, subsurface equipment, and subsurface recovery equipment. Source: **Bowen Itco, Inc., P. O. Box 4587, Houston 13.**

Two-zone-pump design

. . . is the topic of a newly published literature piece which can be obtained now. It describes pump features as: (1) short and simple, easy to handle; (2) very few joints, for simplicity and reliability; (3) connecting components redesigned for great strength and long service life; and (4) long overlapping fluid ports for great flexibility in "between-zone" spacing. Source: **Axelson Div., U. S. Industries, Inc., 6160 South Boyle Avenue, Los Angeles 58.**

Results of 8-year

. . . corrosion tests on wrought iron and 10 structural steels in salt water and lake-water environments are contained in a 12-page report now available. The report contains comparative corrosion-time curves and weight-loss tables. Source: **A. M. Byers Co., 1610 Clark Building, Pittsburgh 22.**

Briggs

PIONEERS IN MODERN OIL FILTRATION

THE TRADEMARK OF DEPENDABILITY YOU HAVE SEEN MANY TIMES FOR OVER A QUARTER OF A CENTURY

FUEL and LUBE OIL FILTERS ●

FILTER/SEPARATORS ●

COMPRESSED AIR AND GAS FILTERS ●

WRITE FOR CATALOG AND DATA SHEETS—NO COST.

PRODUCT OF BUSR RESEARCH

THE BRIGGS FILTRATION CO. DEPT. 345 WASHINGTON 16, D. C.

Circle indicates Bendix LC magneto on White Superior engine at Long Beach.

BENDIX LC MAGNETOS HELP POWER GIANT LONG BEACH WATER-FLOODING PLANT

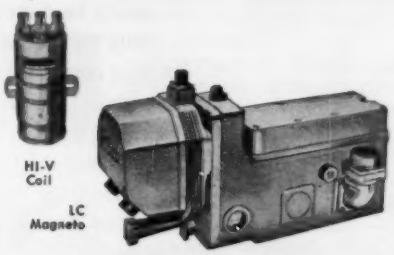
Long Beach, California, operates what may become the world's largest water-flooding plant—drawing water from the Pacific Ocean and pumping it into the Wilmington Tract beneath the city. The additional pressure created will aid in oil recovery and, it is hoped, will reduce land subsidence in the area.

Currently operating at a rate of 120,000 barrels per day, the capacity will be increased and may eventually reach 1,000,000 barrels per day—which would make it the world's largest project of its kind.

The plant is powered by eight White Superior gas engines equipped with Bendix* LC magnetos and HI-V transformer coils. These matched ignition systems, noted for long service life, simplified maintenance at low cost and complete operating reliability, can be used with engines of from six to sixteen cylinders.

If you want to know why major operators are specifying Bendix LC Ignition, write SCINTILLA DIVISION, BENDIX AVIATION CORPORATION, SIDNEY, NEW YORK.

*REG. U.S. PAT. OFF.



MATCHED IGNITION SYSTEM

Export Sales and Service: Bendix International Division, 205 E. 42nd St., New York 17, N. Y. *Canadian Affiliate:* Aviation Electric Ltd., 200 Laurentien Blvd., Montreal 9, Quebec. *Factory Branch Offices:* Burbank, Cal.; Orlando, Fla.; Chicago, Ill.; Teaneck, N. J.; Dallas, Tex.; Seattle, Washington; Washington, D. C.

Scintilla Division
SIDNEY, N. Y.

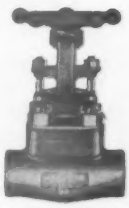
Bendix
AVIATION CORPORATION

RING OF STEEL

Defies Pressure Times Ten

The Flexitallic gasket in the bonnet joint of Hancock Steel Gate Valves cannot blow out even if pressures exceed ten times the rating of the valve. Valve maintenance and equipment down-time are greatly reduced. Made of a spiral-wound ribbon of stainless steel with asbestos filler, the gasket has spring-like compressibility – cannot be flattened.

Only the specially-designed Hancock bonnet joint with built-in compression limit can make full use of the positive sealing power of this ring of steel. Such advanced valve engineering is one example of total Hancock quality that assures trouble-free performance. Your nearby industrial supply distributor will gladly explain every economy feature of Hancock Steel Gate Valves. Phone him today.



Hancock 800# Steel Gate Valve, Type 950. Sizes: ¼" thru 2".

MAXWELL MANNING MM&M & MOORE INC. TRADE MARK

HANCOCK STEEL VALVES

A product of

MANNING, MAXWELL & MOORE, INC.

Valve Division • Watertown, Massachusetts

In Canada: Manning, Maxwell & Moore of Canada, Ltd., Galt, Ontario

▶ ▶ ▶ Equipment Men Notes

Max T. Nigh is appointed

. . . industrial process - control representative for the midwestern region of International Business Machines Corp.'s Data Processing Division. With headquarters in Chicago, he will be responsible for process - control - computer applications.

Nigh joined IBM early this year. He previously was employed as an electrical engineer in the pipeline industry. Prior to that he was a process development engineer with a West Coast research group.

TRAINING PROGRAM has been set up by Baker Oil Tools, Inc., for its sales and service organization. Aim of the program is to increase the participant's ability to better serve his customers and develop managerial skills by broadening his knowledge of all phases of company operations. Baker men in attendance at the training program in Los Angeles were: (from left) E. H. Clark, J. T. Mitchell, R. L. Turner, C. C. Taylor, K. J. Kurtz, N. H. Lytton, G. W. Mitchell, R. S. Bedillion, H. L. Hanright, D. C. Lewis, T. Sutter, G. A. Sullivant, R. B. McCannon, K. E. Hawkins, T. J. Singley, G. M. Anderson, and C. M. King.

Promotion of H. Dan Mathews

. . . from sales and service engineer, drilling - mud department, to the newly created position of assistant advertising manager of Magnet Cove Barium Corp., Houston, has been announced by I. W. Hoskins, senior vice president in charge of marketing. Mathews will have the primary responsibilities of sales promotion, technical writing, analysis of advertising effectiveness, and exhibits and displays. Prior to joining Magcobar in 1956, Mathews served for 5 years in the geology department of Magnolia Petroleum Co.

H. D. Mathews

N. A. Lee Guill becomes

. . . eastern regional sales manager of Chiksan Co., with headquarters in Newark, announces H. J. Hagn, president of the Brea, Calif., manufacturer of ball-bearing swivel joints. Guill will be responsible for sales activities of factory field men and manufacturer's agents in the eastern half of the United States and Canada.

Guill joined Chiksan as salesman in 1949. Formerly senior sales representative based in Chicago, he succeeds J. F. Powers, Jr., who recently became vice president and sales manager of Chiksan.

W. L. (Bill) Clark replaces Guill as representative in the midwest. Previously sales representative in charge of the Chicago sales office, Clark will continue to maintain headquarters in that city.

Clark W. Armold is named

. . . sales representative in the Rocky Mountain area for Well Equipment Mfg. Corp., according to John W. Gates, vice president and sales manager. Armold has been an oil-industry sales-service representative in the Wyoming, Rocky Mountain area for the past 7 years. He will headquarter in Casper, where he has resided for the past 10 years.

Allis-Chalmers Mfg. appoints

. . . Brice Machinery & Controls Co., Houston, as sales representative for industrial machinery and control equipment, according to D. R. (Dave) Boise, A-C district manager for the Houston area. The Brice organization will represent such equipment as switch gear, transformers, high and low-voltage motor controls, a.c. and d.c. integral electric motors, pumps, and specialty industrial items.

T. M. Thompson elected prexy

. . . of General American Transportation Corp., replacing W. J. Stebler, who held the post for the past 6 years. Stebler will remain on the board of directors and will continue to serve as assistant to the chairman of the board.

T. M. Thompson

Thompson went to work for General American in 1939 in the company's East Chicago plant. Following discharge from military service in 1945, he became manager of the company's Cleveland office and was returned to Chicago in 1952 as assistant vice president. In 1958 Thompson was elected to the board of directors and was named vice president in charge of the tank-car-leasing division.

Carter joins Mission Mfg. Co.

. . . as sales representative for the Houma, La., area. Making headquarters in Houma, Edgar Lea Carter will handle sales and service of Mission oil-field equipment in the surrounding area of Southern Louisiana. Prior to joining Mission, he was with Magnet Cove Barium Corp.

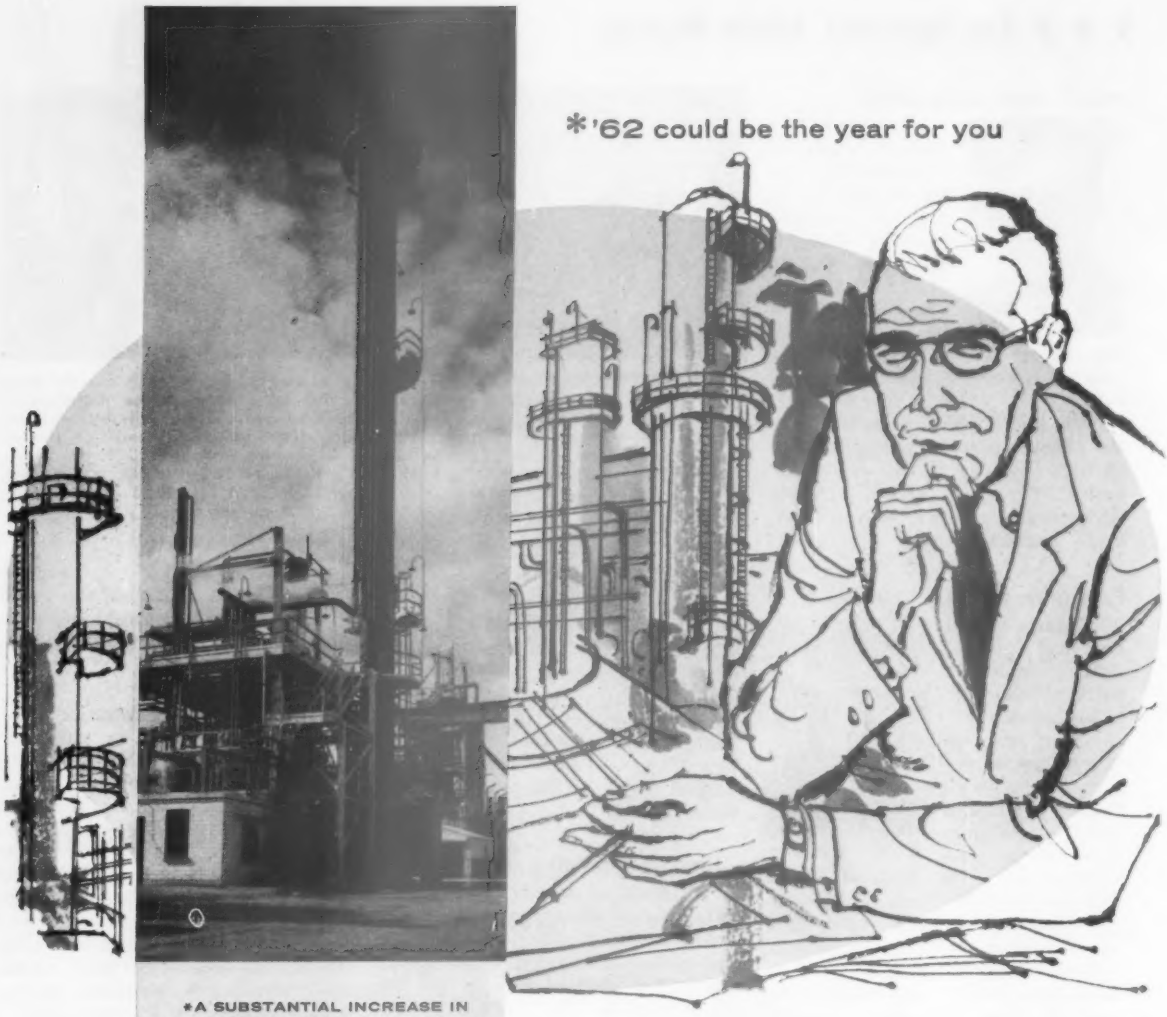
Walworth Co. reorganizes

. . . its sales department to give new emphasis to the marketing of valves. The company has regrouped virtually the entire general office sales unit directed by Harold Brown, vice president of sales.

Reporting to Brown, and responsible for the entire operation of the marketing department is Sidney A. Lewis, former manager, technical sales service. Replacing Lewis is Robert McNally, who is assuming Lewis' former title while retaining his previous position of marine and government sales manager. The advertising department, under the management of Robert L. White, will also become an arm of the marketing department.

W. H. (Bill) Newman joins

. . . the Fishing Tool Division of Wilson Supply Co. as sales supervisor working out of the Houston office. Until his retirement last January, Newman was division drilling superin-



*'62 could be the year for you

*A SUBSTANTIAL INCREASE IN PROCESS CAPACITY will be needed by 1962, according to reliable estimates...NOW is the time to start your planning!

PROCON®

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CHICAGO, ILL., U. S. A.

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TORONTO, ONTARIO, CANADA

PROCON (GREAT BRITAIN) LIMITED,
LONDON, W. C. 2, ENGLAND

PROCON PTY. LIMITED,
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PARIS, FRANCE

PROCON LIMITADA,
SAO PAULO, BRAZIL

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CARACAS, VENEZUELA

REACTORS AND TOWERS THAT PRODUCE PROFITS...

One thing petroleum, petrochemical and chemical plants have in common: Each consists of reactors, piping, tanks, towers, heaters, pumps and other components that must work together to produce profitable products.

Your new processing facilities do just that when you entrust the job to Procon. A world-wide organization specializing in process construction, Procon builds, within your budget, plants that not only meet full performance specifications, but often exceed them!

Before you get too far in planning your next move, call in Procon. We'll be glad to discuss your needs with a view to preparing a detailed proposal.

PROCON *Incorporated*

1111 MT. PROSPECT ROAD, DES PLAINES, ILLINOIS, U.S.A.

WORLD-WIDE CONSTRUCTION FOR THE PETROLEUM, PETROCHEMICAL, AND CHEMICAL INDUSTRIES

tendent for Magnolia Petroleum Co. During 37 years with Magnolia he handled a wide variety of drilling assignments, including the company's offshore operations in the Morgan City, La. area.

Bernard Rodsky to represent

. . . Atlas Mineral Products Co. in the western Texas territory. Working out of El Paso, Rodsky will represent Atlas' acidproof cements, protective coatings, tank linings and rigid plastics.

James E. McDonald is named

J. E. McDonald

. . . manager, mechanical and pressure tubing products for United States Steel's National Tube Division. The report was made by Louis W. Mason, general manager in charge of sales.

Joe W. Hammond is elected

J. W. Hammond

. . . assistant vice president of Seismograph Service Corp., announces G. H. Westby, president. Hammond joined SSC in 1939 as a trainee and in 1941 was promoted to observer and transferred to Venezuela. He later became instrument supervisor for SSC in both Venezuela and Columbia.

Hammond returned to the United States as senior research engineer in 1949, and later was named manager of field research for the firm's international operations. In 1957 he was named staff supervisor for foreign operations, with offices at the Tulsa headquarters.

C. Lee Cook Co. promotes

. . . Charles J. Kremer, Jr., and Richard W. Hoyt to the posts of vice president. Kremer is the new veep

C. J. Kremer, Jr.

R. W. Hoyt

in charge of engineering. He joined the company in 1927 and has served as chief engineer since 1939. Hoyt, former assistant to the president, is now vice president and manager of the Airtomic Products Division. He has been with the company for 25 years.

National Supply Co. appoints

L. A. J. Monroe

. . . L. A. J. Monroe to assistant to N. G. Cummings, vice president of the company. He will locate in Houston. Monroe joined National Supply in 1945 as a floor clerk at the Shreveport store. He became store manager at El Dorado, Ark., in 1946, and at Kilgore, Tex., in 1948. The following year he served as a city salesman in New Orleans. Monroe has been manager of the New Orleans district since 1951.

Visco Products Co. to construct

. . . a $750,000 building adjacent to its present plant site in Sugar Land, Tex., according to Nalco Chemical, Visco's parent company. The new structure, which will increase current research laboratory space, will also house executive offices presently in Houston. The building will contain 22,000 sq. ft. of space, about 14,000 of which will be for laboratory facilities and the rest for office use.

Sooner Pipe & Supply opens

. . . a new oil-field-supply store in Borger, Tex., under the direction of Dick Nash, store manager. Nash previously served as field salesman at Sooner's store in Perryton, Tex. Other personnel at Borger include Claude Rodawalt, field salesman; and Gene Pugh and Jimmie Daniels, storemen.

Lyle Wells is in charge of the corporation's Pampa, Tex., district office

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STEEL FORGINGS, INC.
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Stand lifts, holds, tilts 55 gal. barrels. Prevents spillage—easily loaded.

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and will coordinate activities in the Oklahoma - Texas Panhandle area, which includes stores at Cherokee and Buffalo, Okla., and Perryton and Borger, Tex.

W. Tom Pearson is promoted

. . . to general sales manager of Atlas Pipe Inc., division of Atlas Bradford Co. He joined Atlas Pipe in 1958 as a salesman. Prior to that he was district sales manager in Houston for Lone Star Steel Co. Pearson has held positions as purchasing agent and as salesman with other firms in Houston.

Hilmer A. Olson is elevated

H. A. Olson

. . . to the position of export sales manager of Bowen Itco, Inc., announces Dean Osmun, vice president of the Houston specialty oil-tool manufacturer. Olson had been assistant export manager. After joining the Bowen organization in 1946, he spent the past 14 years in various phases of the export division.

R. L. (Pat) Murphy, Jr. joins

. . . the sales staff of Vinson Supply Co.'s Houston office, announces J. H. Heinzerling, vice president and Houston area manager. Murphy has been a sales engineer in the Houston area for the past 10 years, serving oil-field supply and equipment firms.

LOGGING UNIT now being field tested by Schlumberger Well Surveying Corp., can be disassembled into component packages of 4,000 lb. or less for airlifting to remote locations by helicopter. The unit may be equipped with instruments to provide all of Schlumberger's logging and completion services.

Claude L. Griffin assumes post

C. L. Griffin

. . . as sales manager of Chicago Pneumatic Tool Co.'s Oil Tool division, replacing W. S. Sease who resigned. Formerly vice president in charge of sales for Security Engineering Division of Dresser Industries, Griffin has been associated with the petroleum industry for the past 26 years.

Prior to his service with Security he was vice president in charge of sales for American Iron & Machine Works, Inc. Griffin will locate at the Oil Tool Division's manufacturing facility in Fort Worth.

Tex-Tube names Alvin L. Crow

. . . to the post of district manager of its Mechanical Tube & Special Products Division with headquarters in Dallas. His territory embraces North and West Texas, the Panhandle area, New Mexico, Oklahoma, Arkansas, North Mississippi, and North Louisiana.

Crow was manager of tubing sales for a southwest steel service center for 10 years prior to joining Tex-Tube. He was previously sales manager for Standard Mfg. Co., Dallas.

Water can't harm R&M "All Weather 40" Oil Country Motors!

Robbins & Myers Oil Country Motors are fully protected in all kinds of weather because moisture is locked out. R&M "weatherizing" includes: steel parts undercoated with a rust-resistant . . . iron parts treated with anti-corrosion primer . . . windings twice varnish-dipped and baked. Terminal box is gasketed . . . power leads sealed at shell. Baffles lock out wind-driven rain. Rodent screens are factory-installed. Yet you pay no extra for these dependable R&M 40° heat rise motors! Write today for Bulletin 520-OG

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. . . when compressed, conforms to the shape of the containing body and effects a more permanent, effective seal.

BEFORE PRESSURE

Photomicrograph of Chek-Loss under atmospheric conditions (note voids between particles).

UNDER PRESSURE

Photomicrograph of Chek-Loss when compressed (note the voids between particles have been decreased due to its elasticity).

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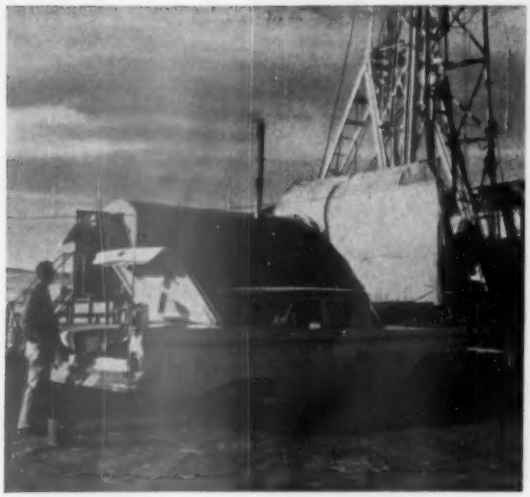

COMPETITIVE specialized services, such as the skilled mud engineer on this record-setting rig, are unknown to the Reds.

Hot American rig

shatters Soviet claims for world's total footage record

THE RUSSIANS are up to their old tricks—inadequate data and false claims.

For example, take the release by PRAVDA, official Soviet paper, in which the claim was made that a Russian drilling crew set a new world record by making 128,572 ft. of hole in 1 year with a single rig. This was reputed as "exceeding an American mark of 125,465 ft. established in 1956."

This "milestone" was accomplished by a drilling crew in the Pre-Azov Oil Trust while working on the Kuban Steppe near Krasnodar (between Rostov and the Black Sea in southwest USSR). The crew reportedly completed 21 wells in the 12-month period. This record was broken by another crew in the same area who drilled 128,493 ft. in completing 22 wells with one rig in 1957.

It never occurred to C. P. Chandler of Chandler & Simpson, Denver, that anyone was trying to set a world's record with a single rig's drilling footage in a year, but he was fairly certain that the Russian mark fell far short of the work done by 25 to 30 rigs working in the Denver basin. Curious, he thumbed through his firm's reports and tallied as he went. Sure enough, the final tally revealed that Chandler & Simpson has almost doubled the Soviet claim.

Chandler passed his information on to the Russian Ambassador and the reply received shortly thereafter stated that "the information will be referred to the proper department." The only comment received later from this department was "What kind of rig did you use?"

Every year Chandler & Simpson are surpassing their own one-rig records. Here's what they've done:

Year	Footage	Wells
1956	216,524	38
1957	238,265	40
1958	*267,427	43
1959	†296,342	47

*Includes 20,623 ft. of 12½-in. surface hole and cored 801 ft.
†Includes 20,576 ft. of 12½-in. surface hole and cored 544 ft.

In 1958, the rig set production strings on 19 wells and the next year they set casing on 20 wells, washed down an old hole, and set pipe.

In all the holes drilled, there was only one small fishing job. In 1957, the rig was down 3 weeks in June due to a fire, but otherwise the tools have been working fairly steady.

The winter weather gets pretty rough in the Denver basin. Temperatures go to 29°-below-zero and the access roads are often muddy and it's tough to get to location. Despite these minor inconveniences, Bill Whitaker, drilling supervisor of Chandler & Simpson, and his crews roll with the blows and keep moving.

The rig is a U-15 with a D-300 pump powered by two 335 Cummins engines on a double L. C. Moore derrick. Whitaker and his team aren't out to set records—they just want to get a good job done.

At best, the Reds are third-rate in this record department. Another firm, Garvey Drilling Co. of Great Bend, Kans., has second place sewed up. Claude W. Bard of Garvey, said that if a firm could keep a rig steadily busy all year long by preplanned scheduling, it would be a simple matter to set a new world's record for total footage drilled in a year by a single unit. His firm hasn't done badly. Look what three of their rigs did in 1957: Rig 16 made 144,289 ft., Rig 19 drilled 159,915 ft., and Rig 17 dug 169,924 ft.

We'll go even farther and say that the Soviets may not be a shoo-in third. Have you checked your totals lately to see how you rate?

Adapted from an article by Loyd L. Hill, service engineer at Sidney, Neb., with Baroid Division, National Lead Co., in Baroid News Bulletin, First Quarter issue, 1960.

- For Drilling
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- 2 and 3 inch sizes Pressures 300-5,000 lbs.

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DEMCO

Two experienced producers get their heads together. Research and progress are reflected in Cabot performance. More and more leading producers use these units because of Cabot's dependability. Cabot units are available with API gear box ratings of 6,400 to 456,000 inch-pounds. Cabot offers a complete line of beam balanced, crank balanced and air balanced units.

How Leading

Production Men Cut Costs

Leading production men select quality equipment for long life and low maintenance. They rightly reason that extra performance and dependable service add up to real economy.

Time proven, blue chip equipment sold by J&L Supply yields dividends for production men who use performance as a yardstick for measuring costs.

Your J&L man has up-to-date literature for your reference on our complete line of quality production equipment.

Invest in quality — and save. Call your J&L Supply man today.

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SUPPLY DIVISION – Tulsa

If it's sold by J&L....
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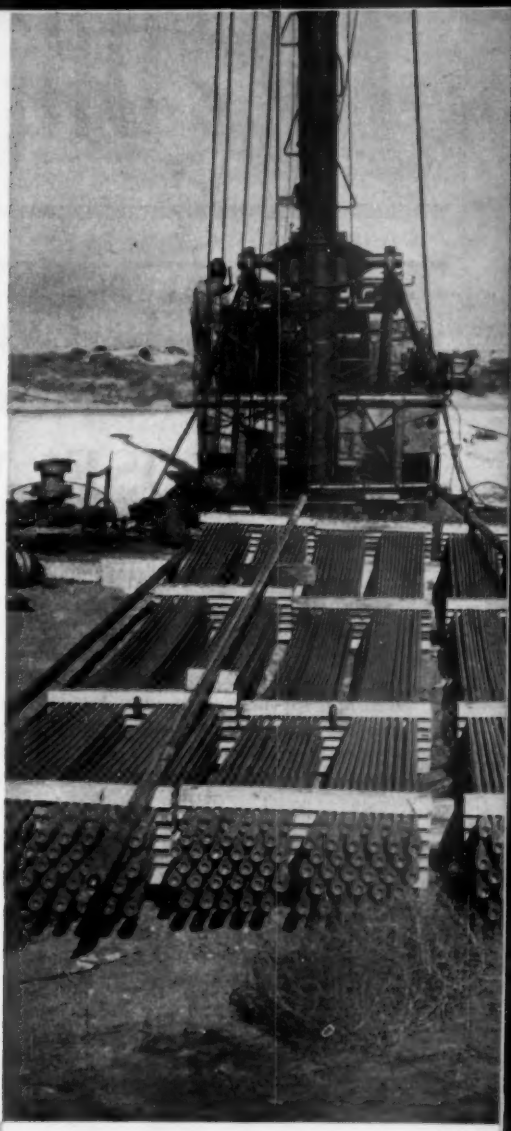


Axelson gives you dependable rod strings and bottom hole pumps designed for varied depths and working conditions. Axelson pumps are tailor-made for problem production such as stripper wells, high volume requirements, sand conditions or corrosive agents. J&L pump shops back up Axelson quality with fast dependable service.

A complete line of Jones & Laughlin casing and tubing is available for your production requirements. Special designs are available in addition to regular API products. J&L Extreme Line* casing, Buttress Thread casing and Grayloc tubing are good examples of our special purpose products. Literature on J&L tubular goods is available today from your local J&L man.

*Manufactured under license from The National Supply Co.

DRISCOSE BRIEFS

DRILLING DATA — REPORT 60-1

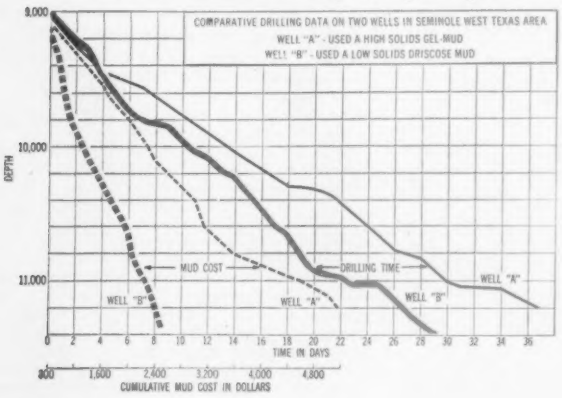
Well Data Evaluations show $15,670 saving when drilling with low solids DRISCOSE* MUD

A study of the data collected on two wells drilled to approximately 11,200 feet in West Texas points out the economy of using low solids Driscose muds. One well was drilled with a high solids gel mud . . . and the other with a low solids Driscose mud.

As shown on the graph below, the well using Driscose low solids mud (Well B, green lines) continued at a faster drilling rate than Well A which used high solids gel mud. The tables of comparative drilling data and costs below tell a more complete story. With Driscose low solids muds, drilling time to 11,200 feet was reduced by 10 days and a total saving of $15,670 was realized.

Low solids mud, containing a minimum of bentonite or other clays, can be tailor-made to meet just about every drilling condition for any given depth. Generally, you start by adding ¾ pound of high viscosity Driscose (99+% pure CMC), 5 pounds of bentonite, and 6 to 8 percent diesel or light crude per barrel of water. This furnishes mud with a viscosity of approximately 16 centipoises. More or less bentonite may be added depending upon the desired viscosity and the quality of the water used. When native mud is used, bentonite is seldom required at the start.

Low solids muds are maintained by adding enough water to hold weight and drilled solids to the desired level, maintaining oil level, and keeping the desired viscosity by adding high viscosity Driscose and bentonite (ratios varying from 1:4 to 1:8, Driscose to bentonite). If needed, a solids settling surfactant emulsifier may be employed to aid in emulsifying oil and settling drilled solids.


COMPARATIVE DRILLING DATA ON TWO WELLS IN SEMINOLE WEST TEXAS AREA
WELL "A" - USED A HIGH SOLIDS GEL-MUD
WELL "B" - USED A LOW SOLIDS DRISCOSE MUD
DEPTH
9,000
10,000
11,000
MUD COST
DRILLING TIME
WELL "A"
WELL "B"
WELL "B"
WELL "A"
WELL "B"
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36
TIME IN DAYS
800 1,600 2,400 3,200 4,000 4,800
CUMULATIVE MUD COST IN DOLLARS

DRILLING DATA

	Well "A" Gel Mud	Well "B" Driscose Mud
Interval Compared	9,000'—11,200'	9,000'—11,200'
Number of Bits (8¾)	38	28
Rotating Hours	344.5	230.5
Average Feet per Rotating Hour	6.4	9.5
Average Feet per Bit	58	79
Increase in Penetration Rate	—	48%
Increase in Footage per Bit	—	36%
Mud Costs	$5,200	$2,600

SAVINGS

10 Days Drilling @ $1100 per Day	$11,000
10 Bits @ $207 each	2,070
Mud Savings	2,600
Total Savings	$15,670

The outstanding advantages of Driscose low solids muds are: (1) the reduction of pressure surges both in the hole and at the annulus, (2) a low water loss which reduces the deposition of filter cake on well bore, (3) mud containing few solids and possessing a high resistance to contaminants, and (4) increased penetration rates with extended bit life.

More complete data on Driscose may be obtained from your mud dealer—or by writing . . .

*A Trademark

DRILLING SPECIALTIES COMPANY
Bartlesville, Oklahoma

GEOLOGISTS have covered the country in selecting sites for their annual national meetings. Host cities for the past 3 years and for the next 5 range from San Francisco to Atlantic City. Shaded area is "oil country" whose boundaries contain only five cities capable of accommodating the meeting.

AAPG national meeting: Retrench—or think big?

BY FRANK J. GARDNER

THE RECENT annual meeting of the American Association of Petroleum Geologists in Atlantic City has launched some soul searching among the membership. It was a good show, but poorly attended . . . only 1,113 members, 140 students, and 81 exhibitors. This was the lowest attendance since 1947.

Why this situation? Perhaps the greatest contributing factor was economics. The site was remote (for oil men) and every delegate cost his company $200 in transportation, if he came from the Mid-Continent—double that if he came from California, Canada, or the Rockies. The condition of oil's pocketbook, plus the current stepchild status of the oil finder, influenced management to shun the meeting, and fewer delegates per company was the rule.

A growing problem . . . But there are other factors involved. For several years now, there's been a growing discontent with the annual AAPG meet.

"It doesn't do much for the younger guys." . . . "They forget I don't own an oil field when they set those prices." . . . "It's a mutual admiration society for the old-timers" . . . "The regional meetings are better" . . . "When you've gone to one, you've gone to 'em all" . . . "Why Atlantic City? The Washington society is host, and I'd a lot rather have gone there."

Those are some of the remarks heard at this latest meeting. There was a definite feeling of dissatisfaction in the air.

And a suggested cure . . . By coincidence, the April issue of the AAPG Bulletin carries a "Suggestion for Streamlining AAPG Annual Meetings," by Lewis G. Weeks, retiring president. He proposes that the annual meeting be scheduled to coincide each spring, in rotation, with one of the annual regionals. Program participation by the national would be limited to perhaps a half day for presidential addresses, awards, etc. The 30-odd standing and special committees of the national association would have an opportunity and a place to meet, while attending a regional program.

Weeks' suggestion reflects the seriousness of the problem, but it tends to ignore reality. Next year the national meeting will be held in Denver, and the Rocky Mountain section of AAPG will forego its annual session. On the surface, this arrangement would seem to be a laboratory experiment for Weeks' idea. But it's not. It's a case of a national meeting **replacing** a regional.

One objection to the Weeks proposal lies in the expanding perspective of the profession. Today's oil finder is more and more a global man. He must be informed on geology and events in Nigeria as well as in Nebraska. The national meeting can bring him papers on the world out there; the regional keeps him posted on local issues. He needs both.

Another problem is physical. The average attendance at national meetings over the past 10 years has huddled at 3,300 people. The Rocky Mountain section held its session this year in Billings, Mont. Can Billings accommodate a national meet? Probably not. And the suggested arrangement would mean an end to regional rotation among cities of that region.

Curious about this, we did some snooping at AAPG headquarters. And the upshot is this: only five cities in so-called "oil country" can accommodate a national meeting. These are Dallas, Houston, Denver, Los Angeles, and New Orleans. Host societies in those cities were aghast at the prospect of entertaining every 5 years, so arrangements were made to hold the national in these five places only in odd-numbered years. In even-numbered years, nonoil centers would be visited, such as New York, Chicago, or St. Louis.

Add up to status quo . . . So the problem is unsolved. Rather than pull in its horns, national headquarters may have to stick out its neck and begin to think in terms of bigger and better meetings, perhaps on an international scale. Good programs, ample publicity, and selling geology to management will pull delegates to any meeting, even if it's held in Atlantic City. Maybe we have an excuse for a thirty-first standing committee here.

Big potential and high recoveries are causing independents to . . .

Take a second look at South Louisiana

CHANCES ARE that many independent operators who are not familiar with the area think only of expensive drilling costs, deep holes, and blowouts when they hear the words "South Louisiana." These factors have probably dissuaded the independents before an appraisal of actual conditions was ever made. Yet some small firms have taken advantage of the excellent potentials and fabulous recoveries of the region by adopting an aggressive attitude coupled with a moderately conservative approach.

Since the discovery of oil in South Louisiana in 1901, the years have been rewarding to many who have met the challenge, while some of the more active independents forestalled entering the picture until the early 1950's The reason for their delay is surprising when one considers that fields like Caillou Island (salt dome), Terrebonne Parish, and Lafitte (probable deep-seated dome) in Jefferson Parish, were both discovered between 1930 and 1935. These two giant (over 100 million barrels) fields have yielded over 240 million barrels of oil between them at the end of 1959. Neither is the largest field in the state, although Caillou Island ranks second while Lafitte is one of the smaller of Louisiana's giant fields in cumulative production.[1] Altogether there are 25 giants in South Louisiana. These include 16 onshore fields, 4 offshore, and 5 fields which are combinations of both.

Enhancing factors related to South Louisiana's large production include: porosities of 28 to 35%; permeabilities of 250 to over 3,000 md.; sand thicknesses ranging from 12 to over 700 ft. per sand; productive sands varying from 2 to over 20 in a single well; water-drive reservoirs; and wider spacing than in some other states (40 acres minimum for oil and 160 acres minimum for gas-distillate wells).

An interesting comparison of success ratios of certain selected areas is

The author . . .

LEWIS C. JARRELL
Consulting Petroleum Geologist
Lafayette, La.

Lewis C. Jarrell has been consulting for 9 years. A native of Columbia, La., he attended Louisiana State University and received a BS degree in geology and petroleum engineering at University of Oklahoma. Prior to going into private practice, he was with Texaco Inc. The areas he worked include Louisiana, North Texas, and southern Oklahoma. He maintained an office in Ardmore, Okla., 7 years before going to Lafayette in 1958.

TABLE 1—WILDCAT WELLS[3]

Area	8-Year Ave. % of Success	No. Wells Drilled
South Louisiana	**34.0**	**4,425**
Texas Panhandle	31.0	650
North Texas	23.5	7,150
Oklahoma	21.5	7,575
Upper Gulf Coast Texas	19.2	3,384
South Texas	10.0	7,793
Mississippi	9.5	1,550

TABLE 2—DEVELOPMENT WELLS[3]

Area	8-Year Ave. % of Success	No. Wells Drilled
Texas Panhandle	93.0	7,500
South Louisiana	**79.0**	**8,900**
Oklahoma	72.0	44,100
Upper Gulf Coast Texas	70.5	10,460
South Texas	66.4	20,200
North Texas	64.0	23,600
Mississippi	61.0	1,700

shown in Table 1. This aspect should be considered by anyone considering the feasibility of operating in South Louisiana. Table 2 is a similar comparison of development wells.

Certain tabulated information is presented to acquaint operators contemplating South Louisiana work with the various prevailing conditions seen in Table 3.

What is the pay out? The average payout on investment varies greatly since the net interest an operator may earn on farmouts depends largely upon the specific locale. For example, the Miocene and Oligocene trends will generally net less to the operator. Conversely, some areas within the Oligocene and many areas in the Miocene trend afford much faster payouts when dual and triple completions are made. The payouts (Table 3) and return on investment are based on one producing sand only.

Another significant factor that is directly related to an operator's interest in a drilling prospect in this country is the topography. The various types of topography encountered in drilling for oil and gas in South Louisiana include: high, dry land, drilled with a conventional rig; in the swamps, barge rigs are used; in marsh country, barge rigs are necessary; and in near-shore bays and the Gulf of Mexico, shallow to deep-water barge rigs are essential.

Recoveries in South Louisiana are excellent. They range from 300 bbl. per acre-ft. in the Cockfield to 600 bbl. per acre-ft. in the Oligocene, and over 1,500 bbl. per acre-ft. in the Miocene. Because of these high recoveries, it is advantageous to seek a trend where possibilities exist for finding more than one pay. Although one can expect a fair return on his investment by drilling in certain areas

"Small firms should pool resources . . ."

within the Cockfield, Sparta, and Wilcox trends, the writer favors selected areas within the Oligocene and Miocene trends. In the latter, one can invest 25 to 35% more on a good prospect and drill an area where the return is more than two times greater than from the shallower sands.

A detailed study of South Louisiana producing fields which have produced over 100,000,000 bbl. of oil since discovery, reveals the following significant data:

Oligocene and Miocene fields accounted for 94% of all the oil produced in South Louisiana to December 31, 1957.

Production from Oligocene and Miocene fields in 1957 comprised 95% of all oil produced in South Louisiana.[2]

This realization of where a region's oil comes from has influenced the writer in recommending exploration of the Oligocene and Miocene trends. Thus it is apparent why most of the acreage is already held by both large and small producing firms within the most favorable trends. Generally the major operators hold the lion's share, and the independents rely upon farmouts and small acreage purchases to meet their requirements. Bonuses are high ($50 to $100 per acre) as are delay rentals ($50 to $100 per acre per year). This affords the independent an advantage because he can use the greatest portion of his tax dollar for exploration. This eliminates the necessity of having to make large acreage purchases and tying up his capital in tangible expenses.

The writer feels that the crude-oil market should enjoy a steady and healthy demand for products because the major firms allocate a large portion of their domestic budget to this area. They are primarily interested in tremendous reserves even though they are deep and may exist in more expensive areas. The oil market itself is practically controlled by the major operators, and it is likely they will continue to protect these large investments. This region offers both large and small companies faster payouts than those in many other parts of the nation.

Louisiana has an efficient and equitable Department of Conservation. This fact alone should encourage new operators. This regulatory body has adopted a conservative outlook, thereby leading to a wider spacing of wells in Louisiana. While most oil wells are set at a 40-acre per well pattern, others are drilled on 80-acre spacing. Gas-condensate wells vary upward from 160 acres per well. The exception to usual spacing patterns occurs around salt domes. There, no spacing limitations exist because of the complex faulting and steep dips. Most of the known domes have been leased, and many are held by production. Few opportunities exist for new operators in these areas.

Recommendations for new operators. The following suggestions are offered to those contemplating new operations in South Louisiana:

- Small firms should pool resources by forming combines or partnerships, and allocate a minimum of $500,000 for **drilling only** during the first year.
- An effort should be made to concentrate on offset, close-in, or extension-type prospects based upon good subsurface geology. A minimum of three or four wells should be planned in the initial program.
- Drill one or two wildcats on trends that offer maximum returns for minimum investment.
- The search should be primarily for oil unless the prospect lies within 1 mile of existing gas lines.
- Seek Oligocene and Miocene prospects first. Secondary consideration should be given good Cockfield

TABLE 3

Formation	Depth Range	Average Allowable Per Month (Bbl.)	Average Drilling & Cptn.	Average Payout (Months)	Average Return on Investment
Wilcox*	8,500-14,000	3,420	$145,000	24	5.3:1
Sparta	10,000-12,000	3,330	$160,000	26	2.9:1
Cockfield	7,500-11,000	2,490	$ 90,000	18	3,6:1
Oligocene:					
(a) Without protective pipe	8,000-10,600	2,790	$110,000	18	8.0:1
(b) With protective pipe	11,500-13,000	3,720	$275,000	40	6.0:1
Miocene:					
(a) Without protective pipe	6,000-13,500	4,410	$200,000	31	8.1:1
(b) With protective pipe	12,500-15,000	4,800	$500,000	60	10.0:1

*Eocene age.

prospects which are occasionally available.

• The initial effort should consist of a small office force, the smaller the better. A geologist to screen prospects rather than originate plays is feasible. Some of the large firms employ as many as 30 exploration technicians in an effort to provide a consistent number of drillable ventures. Quite often, in the writer's opinion, an acceptable number of high-grade prospects are delivered to the larger firms by consulting geologists despite these large staffs.

Look to South Louisiana as a prime area for maximum return with the smallest risk.

Acknowledgment

Many people, too numerous to name, have provided ideas to the writer and encouraged the preparation of this paper. Particularly helpful were Clyde Willhite, manager of Drafting Services Co., Lafayette, and Bayou Reproductions, Inc., Lafayette. The writer also expresses his appreciation to two of his clients, Perkins Oil Co., Wichita Falls, and Headington Oil Co., Oklahoma City.

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APRIL MULTIPLE COMPLETIONS

	DUAL	TRIPLE
Arkansas	2	...
Louisiana	37	2
North	6	2
South	23	...
Offshore*	8	...
Mississippi	3	...
Montana	1	...
New Mexico	7	...
West	3	...
East	4	...
Oklahoma	32	...
Texas	51	5
Dist. 1	4	...
Dist. 2	...	1
Dist. 3	9	...
Dist. 4	9	1
East	7	...
Dist. 7-B	1	...
West	13	1
Dist. 9	2	2
Dist. 10	6	...
Total U. S.	133	7

*Has 1 quadruple well.

Arizona wildcat is quit as a dry hole

In Apache County, northeastern Arizona, British-American Oil Producing Co. abandoned 1 Navajo-C in SW SW 5-40n-30e.

The well was a tight hole. Total depth is below 6,200 ft. in Cambrian. Location is 6 miles south of Bita Peak field. Texaco Inc. is drilling 5½ miles northeast of this dry hole at 1 Navajo-Z in NW SW 36-41n-30e. Drill is below 6,615 ft. There were good helium shows in Mississippian.

Central Alberta slated for test

IN CANADA the team of Sohio Petroleum Co. and United Producing Co. has staked location for an exploratory test in the Ardley district of Central Alberta, 22 miles east of Red Deer. The new venture falls on lands acquired under farmout agreement from British American Oil Co., Ltd., Canada Cities Service Petroleum Corp. and Pan American Petroleum Corp.

• Shell Oil Co. of Canada, Ltd., announced location for a well in the general Lookout Butte-Waterton Park district of southwestern Alberta, 3½ miles north of the U. S.-Canadian international boundary and 130 miles south of Calgary.

• Bailey Selburn Oil & Gas has staked location for another test in the general Crossfield district of southwestern Alberta, 23 miles northwest of Calgary.

• Bailey Selburn Oil & Gas Co., Ltd., has discovered light-gravity crude oil in the Cardium sand at a recently drilled well in the general Crossfield-Carstairs district of southwestern Alberta. The recent strike indicates even further the occurrence of a continuous trend in the Cardium sand from the Westcott pool, 35 miles northwest of Calgary southeasterly to at least Beddington some 5 miles north of Calgary's city limits.

• Atair Oil & Gas Company and a firm participating in the western Canadian oil and gas industry for the first time, Apache Oil Corp. of Tulsa will jointly drill an exploratory test in the Drumheller city and 65 miles northwest of Calgary.

New oil field opens in South Louisiana

New oil production is reported at a Cameron Parish wildcat. It is Texaco Inc. 1 Cameron Meadows Land, 5 miles north of Johnson Bayou field in 21-14s-14w.

The well was completed flowing 202 bbl. of oil per day with 191 M.c.f.d. from 8,231-41 ft., a 10-ft. pay zone. Flow was on 6/64-in. choke.

Jefferson Davis. The California Co. ran state potential at its 1 J. M. Pettijean gas discovery in 17-11s-4w, Jefferson Davis Parish.

The well was completed from 11,461-81 ft. flowing 8,200 M.c.f.d. and 264 bbl. 31°-gravity oil daily. Gage was on 18/64-in. choke. This new field is 1½ miles northeast of South Thornwell field.

Hollywood. In Terrebonne Parish's Hollywood field, Mecom Petroleum Co. added a dual producer at 2 Southdown Sugars in 87-17s-17e.

The well, located on the southwest flank of the field, flowed 36 bbl. of 50.5°-gravity oil per day and 1,890 M.c.f.d. from the upper sand on 2-hour test through 10/64-in. choke. Perforations were at 12,360-12,408 ft.

The lower zone at 12,605-18 ft. made 42 bbl. oil per day and 2,245 M.c.f.d. through same choke.

Second Amsden well completed in Montana area

The second Amsden Pennsylvanian producer at Ivanhoe field in Musselshell County, Central Montana, is Juniper Oil & Mining Co. 1 NPRR in SW NW NE 17-11n-31e. It flowed 295 bbl. of oil per day from perforations at 3,446-66 ft. Flow was through ⅛-in. choke.

The well also has Tyler sand production at 4,057-62 ft., but no potential is reported. The new well lies ¾ mile northeast of the Amsden new-pay discovery completed a few weeks ago at Winston L. Cox et al. 1 NP in SE NW 17-11n-31e. That well flowed 277 bbl. daily on 16/64-in. choke from perforations at 3,493-3,516 ft.

Mississippi's Smithdale discovery potentialed

A new lower Tuscaloosa oil discovery in South Mississippi flowed 157 bbl. of oil per day on potential gage from perforations at 11,062-68 ft. opposite an estimated 9 ft. of net oil pay logged at 11,062-71 ft. It is Larco Drilling Co. et al. 1 Paul A. Dykes et al. in 21-4n-6e.

Smithdale field is located 6 miles northwest of McComb field, another lower Tuscaloosa field. Initial test at the Smithdale opener made 336 bbl. per day on 10/64-in. choke. This is an important addition to the growing trend toward lower Tuscaloosa exploration in Mississippi.

Mississippi field adds new pay zone

Wayne County's Thompson Creek field in Mississippi now has a new pay in Washita-Fredericksburg. The discovery well is Placid Oil Co. A-1 Strickland et al. in SE NE 15-7n-9w.

The well pumped 135 bbl. of 19.6°-gravity oil daily on test at 8,538-48 ft. The discovery also produces from regular field pay, the Massive sand, at 8,130-56 ft. That zone got 175 bbl. of 19.5°-gravity oil per day on pump.

New Jersey may be future oil site

One interesting aspect of oil finding being discussed these days is the question of what a future oil deposit looks like today. According to Edwin W. Biederman Jr. of the Cities Service Research & Development Co., the New Jersey coast may be such a future oil pool.

Biederman, describing studies of grain size and composition and amounts of organic matter in various coastline deposition areas, concluded that the most likely sources of petroleum are the marshes between the beaches and the mainland. Petroleum formed here may migrate to sand bars and the beaches where future oil wells may be located.

Over long periods of time similar deposition has been going on so that coastal deposits are many thousand feet thick. In the Gulf Coast area, deposits that may be of similar origin have been exploited for many years. Oil could exist in deep New Jersey sands, but the present coastal deposits will have to be buried under additional thousands of feet of muds and sands before we can hope to find oil.

Ohio has another gasser in Vinton County

In Ohio, Ohio Fuel Gas Co. reports another gasser in its new pool development in northwestern Jackson Township, Vinton County. The stepout 3 Elbert Turner, Section 7, logged the Clinton sand at 2,272-80 ft. The well had a natural gage of 11 M.c.f.d. and 1,230 M.c.f.d. after fracture with a rock pressure of 885 psi.

• National Gas & Oil Corp. have announced an increase under its local gas-purchase contracts with independents to 25 cents per 1 M.c.f. The general area of their operations include Licking, Coshocton, Perry, and Muskingum counties.

Oil hunting in Wyoming:

Jurassic and Pennsylvanian wells slated in Wyoming

Northeastern Wyoming's Powder River basin counties of Crook and Campbell, busiest two areas in the state, picked up new exploration.

Shar-Alan Oil Co. will drill a 5,300-ft. Minnelusa Pennsylvanian wildcat at 1 Moore in C SW SE 27-49n-67w, 1 mile south of Kara field in Crook County. Nearest Minnelusa activity is 1 mile southeast.

In Campbell County, Davis Oil Co. will drill 1 Federal-Whisler in SW SE 34-51n-70w, 2¼ miles north of Rozet field. This well will go to 7,200 ft. or Morrison. Rozet produces from Muddy Cretaceous.

North Fork. Texaco Inc. 1 Cellers, NW SW 13-44n-82w, north extension well to North Fork field in Johnson County, pumped 165 bbl. of oil and 625 bbl. water daily from Tensleep Pennsylvanian at 6,536-6,642 ft. This well is the north extension to 1 State in SW SW 13-44n-82w, a March discovery that pumped 358 bbl. per day. That well extended North Fork field 1 mile northwest. Texaco will also drill in Section 13 at 4 Government-Taylor in SE SW. This 6,800-ft. try will also go to Tensleep.

Minnelusa test slated for South Powder river

The big push to Pennsylvanian rocks in northeastern Wyoming's Powder River basin is shifting to the south. Signal Drilling & Exploration Co., W. S. Kilroy, and King-Stevenson Oil Co. will take an old hole, the 1 Government in C SE SE 5-40n-68w, Converse County, down to Minnelusa at 11,150 ft., or 200 ft. into the zone.

The well was drilled 9 years ago by A. B. Cobb and Superior Oil Co., abandoned in Spearfish Triassic at 10,060 ft. One test was made in Dakota Cretaceous with no shows. Closest Minnelusa drilling was down 5 years ago at Rochelle Oil Co. 1 Government, 18 miles north in C NW SE 1-43n-69w, Campbell County. Minnelusa was topped at 9,985 ft. It had a show of oil and gas. Closest Minnelusa production is at Lance Creek field, 35 miles southeast. There is Minnelusa production at Mule Creek, 40 miles east, and at Kewanee Oil Co. 1 Norman in Campbell County, a current discovery.

Location made for Arch unit extension well

Location has been staked for Forest Oil Corp. and Union Pacific Railroad Co. 19-2 Arch Unit in C NW SW 19-19n-98w, Sweetwater County, Green River basin, Wyoming.

This new well is 1 mile east of the Almond Cretaceous oil discovery at 19-1 Arch Unit, recently completed in SE SW 19-19n-98w for 607 bbl. of flowing oil daily on ½-in. choke from perforations at 5,066-90 ft.

Since the completion of that discovery, Colorado Oil & Gas Co. and St. Helens Petroleum Co. have staked five locations south of the well to a point within 1 mile of the north end of Patrick Draw field. Colorado 1-30 Government in NW NW 30-19n-98w, one of the south extension wells, has perforated Almond sand at 5,027-41 ft. No cores or tests have been made yet. These wells will be watched closely as a clue to the limits of both fields, or a possible linkup.

North Dakota trio receives nomenclature

Three new fields were officially named by the North Dakota Industrial Commission in Bismarck.

Gros Ventre field is the name given a discovery at Wilhite 1 Pixley in SE SE 23-160n-93w, Burke County. The well pumped 40 bbl. of oil per day plus 50% water from Midale Mississippian at 7,580-90 ft. The field was defined thusly. W½ 13, 24, 25, E½ 15, 22, 27, N½ 35, NE 34, NW 36, all 14 through 23, 26-160n-93w. Temporary 160-acre spacing was set.

Eden Valley is the field name for British-American Oil Producing Co.'s 1 Van De Erve in SW SE 15-163n-84w, Renville County. This well, still testing, pumped 37 bbl. of oil and 100 bbl. water daily on last reported production tests. Definition is S½ 9, 10, 11, N½ 26, 27, 28, all 14, 15, 16, 21, 22, 23-163n-84w. Temporary 80-acre spacing was set.

Cedar Creek is Shell Oil Co.'s 41-23 Government-Unit discovery in C NE NE 23-130n-107w, Bowman County. It pumped 41 bbl. per day plus 28% water. Definition for the 80-acre spacing field is E½ 34, all 35, SW, W½ NW 36-131n-107w, E½ 3, 10, 15, 22, S½ NW, W½ NE 1, N½, N½, SE, SE SE 26, W½ NE 27, NE, NE NW 36, all 2, 11, 12, 13, 14, 23, 24, 25-130n-107w, W½ W½ 7, SW, W½ NW 18, W½, 19, 30, NW 31-130n-106w.

Here's the drilling picture in Texas:

Morrow confirmation finaled in Texas

Morrow Pennsylvanian gas production was confirmed at a well in the Texas Panhandle. James F. Smith et al. confirmed the 1 Conden in Ochiltree County for 1,800 M.c.f.d. from 7,612-20 ft. This is a northeast offset discovery to the pool opener which made 6,100 M.c.f.d. Location is in Section 93, Block 11, W. Ahrenbeck Survey, 6 miles northwest of Perryton in the northwestern part of the county.

Texas dry hole converted to gas discovery

A wildcat in Panola County, Texas, that was abandoned in 1944 as uncommercial has been reentered and converted into a gas-discovery well.

Reworking was by Jack L. Smith, who tested a 7-ft. interval that had been logged at 6,700 ft. in Travis Peak sand. Flow was estimated at 3 M.M.c.f.d. of gas.

Location of the well, 1 A. R. Scharmaegel, in the Catherine Lindsey Survey, is 4 miles southeast of Pine Hill. This is 3 miles west of the giant Carthage gas field.

Hole had been drilled by its former operators (Southport Petroleum Co. and associates) to 6,910 ft.

Strawn oil found in Texas wildcat

A southern Tom Green County wildcat in West Texas, 6 miles south of Knickerbocker, found oil on a drill-stem test of Strawn Pennsylvanian at 6,857-6,952 ft. It is British-American Oil Producing Co. 1 S. N. Allen, 5 miles south of Atkinson field in Section 16, Block 21, H&TC Survey.

Recovery on the test was 5,300 ft. of 41°-gravity oil plus 100 ft. oil-cut mud. Another test is being made at 6,952-77 ft.

West Central Texas discovery extended

A southeastern extension discovery to a recent Flippen sand discovery in Taylor County, Texas, pumped 33 bbl. of 36°-gravity oil daily from perforations at 2,408-13 ft. It is J. R. Elliott and J. W. King Drilling Co. 1 R. E. Dillard, ½ mile southeast of Flippen sand production in the central part of the county. Discovery well of the field was Skelly Oil Co. 1 Brookerson. Production is prorated in Regular field.

Location of the extension discovery is in Section 7, Block 3, SPRR Survey, 4½ miles northwest of Tuscola.

O. B. Kiel, Jr. has an indicated Flippen sand well in the same area 1 W. R. Richards in S. Andrews Survey, 4 miles southwest of Buffalo Gap. A drill-stem test at 2,423-30 ft. got 660 ft. of oil and 180 ft. mud-cut oil. This well is a ½-mile southwest extension to the previously mentioned discovery.

Oil flows at South Texas wildcat discovery

A Jackson County wildcat in South Texas flowed an ungaged amount of 22°-gravity oil per day from perforations at 2,459-68 ft. The well is H. H. Howell 2-B McNeil between the Collier and Cordele fields, 6 miles northwest of Edna.

The well is in the southwest of John Andrews Survey A-4. A confirmation will be put down 933 ft. northeast of the new well.

Refugio. The 3,800-ft. zone is a new gas pay for the Wyrick field area. Kirkwood & Morgan Inc. 2 A. D. Rooke was completed flowing 1,184 M.c.f.d. from perforations at 3,782-84 ft. It lies ½ mile northeast of the 1 well, a dual producer. Calculated open-flow potential of the 2 Rooke was 8,800 M.c.f.d.

Big Wilcox gasser in Texas' Jim Hogg

The Wilcox gas trend in Southwest Texas' Jim Hogg County area added a big well. It is Atlantic Refining Co. 3 Marrs McLean, 5,000 ft. south of the discovery well in Las Animas Grant, A-244, 10 miles west of Hebbronville.

This new well in the Northwest Thompsonville area flowed on calculated open-flow potential 78 M.M. c.f.d. from perforations in the First Hinnant field pay at 9,400-13 and 9,419-36 ft.

New oil found at Southwest Texas wildcat

A deep test off the northeast side of East Telferner field in Victoria County, South Texas, found oil in the 5,100-ft. Frio zone.

The discovery well is Catahoula Oil & Gas Co. 1 Owen Kolle in the Thomas Burnham Survey, A-132, 5 miles southeast of Telferner. It flowed 52 bbl. of oil daily on 10/64-in. choke from 5,100-ft. Frio pay through perforations at 5,090-93 ft. Established production in the area is just below 4,400 ft. in Frio.

Refugio. Phil Power gas field in northwestern Refugio County has its third well. Humble Oil & Refining Co. 1 Mrs. Edith Clarkson in the B. F. West Survey, A-366, 6 miles north of Vidauri, flowed 1,315 M.c.f.d. on 7/32-in. choke from perforations at 4,419-23 ft. Open-flow rate was calculated at 2,500 M.c.f.d. The well is ½ mile southwest of nearest production in the field. The other two wells in the field, 1 and 2 Mary Agnes Power Shay, were 5,000 and 5,500-ft. producers.

Unproductive Texas salt dome finally yields gas strike

A shallow sand gas well has been completed on the long-known, but until now unproductive Ferguson Crossing salt dome in Grimes County, South Texas.

Grimes County is one of the sparsely explored more inland counties of the Upper coastal region. Only in three other places has any production been found. These have been small with development limited to one or two wells.

Nearest production has been not less than 15 miles distant.

Discovery well on the Ferguson Crossing dome is Texaco Inc.'s 1 R. P. Trant, in BBB&C Survey. It is productive of dry gas from Queen City sand, perforated at 1,726-32 ft. Flow through 21/64-in. choke tested 1,230 M.c.f.d. with 589 psi. Absolute open flow is rated at 3,230 M.c.f.d.

What little other production there has been in the county has been from the geologically deeper Wilcox sands.

Ferguson Crossing dome is on the western edge of the county, extending under Brazos River into eastern Brazos County. Location of the well is 7 miles northwest of Piedmont, and about 10 miles southeast of Texas A&M College in Brazos County.

The dome was discovered by Humble Oil & Refining Co. in 1934 with a well that topped characteristic cap rock at 3,840 ft., and penetrated salt at 4,038 to 4,170 ft.

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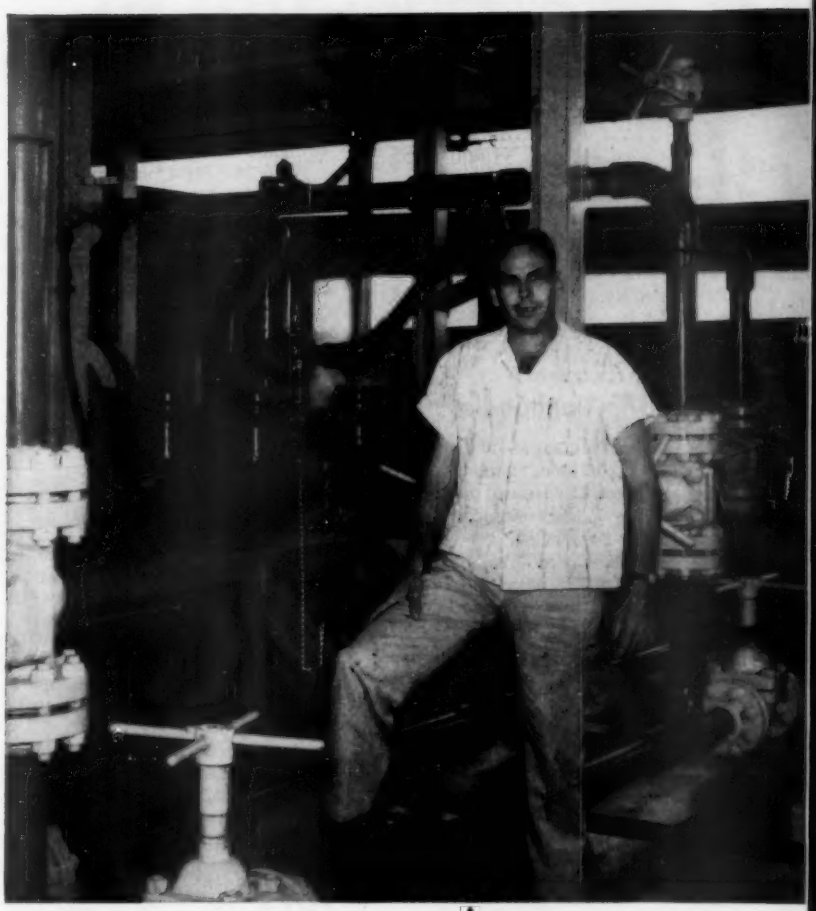
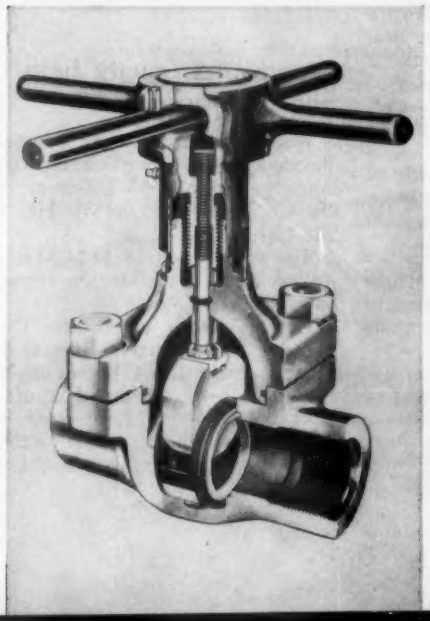


▲ Ray Bounds, Tool Pusher for the Bay Drilling Corp., finds that his men like Edward Mudwonder valves because they are easy to operate and easy to maintain.



◀ Mudwonder cut-away view shows the one-piece seat insert with Buna-N molded integrally over steel wear rings; chromed gate with "T" slot connection; separated stainless stem and double thread construction.

Oklahoma drilling activity spreads over

Second deep well shows in Oklahoma Panhandle

The Guymon area of Hugoton field in Texas County, Oklahoma, has another deep Morrow Pennsylvanian gas discovery. It is Cities Service Oil Co. 1 Heir-A in C SE NW 21-5n-15eCM, south of a previous similar discovery.

The well flowed 12,900 M.c.f.d., natural, from perforations at 6,148-50 ft. More zone was uncovered at 6,128-38 ft. Gage was then 51,600 M.c.f.d. This discovery is south of Hamilton Brothers 1-16 Daily Unit in C SE NW 16-5n-15eCM. That well flowed 11,800 M.c.f.d. and 2½ bbl. condensate per million on completion last winter. Perforations were at 6,120-30 and 6,140-58 ft.

Oil-gas discovery finaled in Panhandle

Southwest Elmwood field in Beaver County, Oklahoma, gained a good well at Carter Division of Humble Oil & Refining Co.'s 1 Schlehofer in C NW NW 2-1n-23eCM.

The well flowed 276 bbl. of oil per day and 3,776 M.c.f.d. from Morrow Pennsylvanian perforations at 7,678-92 ft. Open flow was 4,263 M.c.f.d., calculated.

East Camrick. In this field, Carter 1 Thomas, C NW SE 35-1n-20eCM, swabbed 262 bbl. of oil in 20 hours, or 314 bbl. per day. Morrow perforations were at 7,510-16 and 7,521-29 ft.

Confirmation assured at Panhandle gasser

Confirmation of a new Morrow Pennsylvanian gas discovery in Beaver County, Oklahoma Panhandle, is assured. Stekoll Petroleum Corp. 1-35 Laughrin, C SW NE 35-3n-23eCM, flowed 7 M.M.c.f.d. from lower Morrow perforations at 7,524-37 ft.

This well is 4½ miles north of Elmwood, 2 miles north of Northwest Elmwood field, and is a 1-mile-south offset and confirmer to 1-26 Ellis.

Southwest Kansas. Perry Ranch Mississippian gas field in Comanche County, southwestern Kansas, appears assured of confirmation.

Kern Drilling Co. 1 Shutte in SW NE 2-32s-16w, 11 miles southeast of Wilmore and a northeast offset to Messman-Rinehart 1 Perry, discovery and lone well in the field, flowed 1,800 M.c.f.d. and 28 bbl. of new oil in 6 hours from Mississippian at 4,810-22 ft.

Texas Panhandle. The Frass multi-pay field in north-central Lipscomb County, Texas, has been confirmed and extended 2 miles west at Humble Oil & Refining Co. 1 Henry Frass, Jr. "F," Section 19, Block 10, HT&B Survey.

The upper Morrow gas well is 3 miles northwest of Darrouzett. It was completed for a calculated open flow of 1,150 M.c.f.d. Completion was also made in middle and lower Morrow sand at 8,690-8,715 and 8,748-56 ft. Open flow was 10,200 M.c.f.d. This is the third producer from Morrow sands in the field.

Oklahoma's Dewey adds sixth pool

Western Oklahoma's Dewey County has its sixth producing area. Carter Division of Humble Oil & Refining Co. completed 1 Spangler in C SW NE 13-17n-19w, west of West Valley Center field, flowing 48 bbl. of oil daily through 18/64-in. choke from Tonkawa Pennsylvanian sand at 7,820 to 7,918 ft. Gas-oil ratio was 3,225:1.

Ellis County. Two wells were completed in this western Oklahoma county. Shell Oil Co. 1 Sheppard in C SE NW 12-23n-26w, Catesby field, flowed 3,100 M.c.f.d. and 10 bbl. condensate per million from Morrow Pennsylvanian sand through perforations at 8,442 to 8,514 ft.

At North Salon field, Shell 1-26 Long, C NE SW 26-24n-24w, flowed 5 M.M.c.f.d. and 8½ bbl. condensate per million from Morrow at 7,875 to 7,963 ft. This is the second well in this field.

Woodward County field adds big gasser

Woodward County's Southeast Woodward field in northwestern Oklahoma gained a good gasser at Sun Oil Co. 1 Guthrie in SW NE 23-22n-20w.

The well flowed 18 M.M.c.f.d. on drill-stem test in the Morrow Pennsylvanian at 8,241-89 ft.

Grant County. In northern Oklahoma's Grant County, Gungoll and Gungoll completed 1 Becker in NW NW 21-27n-4w for 600 bbl. of oil daily on 22/64-in. choke from Red Fork Pennsylvanian sand at 4,825 ft. This big well is in North Satchell Valley field.

Gas-condensate strike finaled in Oklahoma

Woodward County in northwestern Oklahoma has a new gas-condensate pool. Shell Oil Co. 1-21 State-Blasdel in C SW NE 21-23n-22w, 4 miles northwest of Tangler, was completed for a calculated open-flow potential of 5,850 M.c.f.d. from perforations in Morrow Pennsylvanian sand at 8,134 to 8,172 ft. The well also made 8.5 bbl. condensate per million.

This new Pennsylvanian field is in the northwestern part of the county, 6 miles southeast of Fort Supply field.

Deep western Oklahoma gas field extended

North Custer City field, a Hunton Siluro-Devonian prize Mobil Oil Co., was extended 1 mile east at 1 Webb Unit in C SE NW 23-15n-16w. This well offsets the discovery well. It flowed 3,200 M.c.f.d. on test of Hunton at 14,194-14,337 ft.

In Oklahoma, Apache Oil Corp. reports gas and distillate on drill-stem test of its wildcat 1 Sanders, C NE SW 11-16n-8w, in the Loyal area of Kingfisher County.

The Manning zone was tested from 7,942-8,089 ft. and the tool was open 2 hours. Gas surfaced in 7 minutes and a 2,700 M.c.f. flow was gaged in 2 hours. The recovery included 288 ft. of distillate-cut mud. Flow pressure was 85 lb.

The well is 5½ miles northwest of Apache's 1 Snow, a major gas discovery.

Oklahoma's North Okarche adds third producer

The third producer in North Okarche field, Kingfisher County, West Central Oklahoma, is Ohio Oil Co. 1 Mallen in C NW SE 18-15n-7w.

This new well flowed 8 M.M.c.f.d. through 26/64-in. choke from Manning Mississippian sand through perforations at 8,179-92 ft.

In another Kingfisher County area, Sinclair Oil & Gas Co. 1 Myers in C NE SE 22-18n-7w, flowed 49 bbl. of oil in 1 hour on ¼-in. choke with 219 M.c.f.d. from Manning at 7,010-46 ft. Humble's 1 Crossley in C SW NW 14-18n-7w flowed 346 bbl. of oil in 6 hours on ½-in. choke from the Manning at 6,952-7,009 ft.

King-Stevenson Oil Co. 1 Myers in C SW NE 22-18n-7w, North Dover field, is a new producer. The well

entire state

flowed 200 bbl. of oil per day on ¼-in. choke from Manning sand at 7,012-23 ft.

Oswego oil found at Kingfisher County well

Kingfisher County in West Central Oklahoma has a new Oswego Pennsylvanian discovery at Jones and Pellow Oil Co. 1 Corrie in C NW NW 26-19n-6w, 2 miles southeast of East Hennessey pool.

The well was completed flowing 254 bbl. of oil in 24 hours on ¼-in. choke from Oswego perforations at 6,252-60 ft. Tubing pressure was 200 psi., casing pressure 450 psi.

East Criner field gets well in Oklahoma

McClain County's East Criner field in South Central Oklahoma has a new well. It is Sinclair Oil & Gas Co. 1 Bingaman in SW SW 21-6n-3w. Initial potential was 277 bbl. of oil in 24 hours on 10/64-in. choke. Flow was from Bromide Ordovician sand perforations at 9,726-50 ft.

Southwest Oklahoma field extended in Comanche

Southeast Sterling field, a 1959 discovery in southwestern Oklahoma's Comanche County, gained an extension well at Woods Petroleum Co. 1 Wilson in C NE NE 20-3n-9w.

The well flowed 2,500 M.c.f.d. with 5 gal. condensate on test at 6,945-59 ft. Another test at 7,033-55 ft. got 11,500 M.c.f.d. with 5 gal. condensate. Test at 7,145-70 ft. got 1,250 M.c.f.d.

Deep test. Gulf Oil Corp. will drill a deep 16,000 ft. Springer Pennsylvanian sand wildcat in the Laverty district of Grady County. The 1 Wood is under way. Location is C WL SE NW 29-6n-8w.

Skinner is new pay at Oklahoma field

The lower Skinner Pennsylvanian is a new pay in East Billings field, Noble County, northern Oklahoma. Texaco Inc. 2 Back is the discovery in SW NW SW 27-24n-2w.

The well flowed 20 bbl. of oil in 45 minutes on ½-in. choke from perforations at 4,256-62 ft. Flow was 2,090 M.c.f.d. A later test made 27 bbl. of oil and 25 bbl. load water in 16 hours through ¼-in. choke and

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1,032 M.c.f.d. The regular field pay is Mississippi Chat. It made 16 bbl. on swab test through open hole at 4,426-43 ft.

Dakota gas discovery completed in Utah

Grand County, Utah, has new Dakota Cretaceous gas production. B. W. Hancock 4 Government in SW SW 9-17s-25e, 1 mile north of Entrada production at West Bar X field, flowed 1,279 M.c.f.d. from Dakota at 3,858-86 ft. It also flowed gas from Cedar Mountain at 2,450 M.c.f.d. from 3,956-78 ft.

Southeast New Mexico gets Penn discovery

Additional Pennsylvanian oil is in store for southeastern New Mexico as a result of a new discovery in Lea County, 20 miles southeast of Caprock. The discovery well is James G. Brown & Associates 1 Lion State in 9-14s-33e, 2 miles northwest of Saunders field, 2 miles southeast of Baum-Wolfcamp field.

The pool opener pumped 250 bbl. of oil per day. Production is from perforations at 9,954-80 ft.

Denver basin discovery completed in Nebraska

Kimball County in western Nebraska has a new "J" sand Dakota Cretaceous discovery at Wyoming Western Oil Co. and U. S. Smelting, Refining, & Mining Co. 1 Chamberlain in C NW SW 26-14n-58w.

The operators completed the well on pump for 276 bbl. of oil daily from perforations at 7,176-80 ft. The new field is 3 miles southwest of production in 19-14n-57w, a "J" sand producer. It lies 3¼ miles south of Bartow "J" sand production.

Nebraska extension well flows Dakota oil

An extension well to Russell field in Kimball County, Nebraska, was completed pumping 175 bbl. of oil daily. It is Braden Drilling Co. 5 Peterson in SW NE 14-16n-58w.

Production is from "J" sand Dakota Cretaceous through perforations at 7,105-7 ft. The well lies ¼ mile west of field production.

Denver basin. Other Denver basin news includes a small oil discovery in Yuma County, northeastern Colorado—the county's first oil field.

S. D. Johnson et al. completed 1 State in SW SW 16-2n-42w, 40 miles east of nearest basin production in Colorado, pumping 11 bbl. per day from Lansing-Kansas City Pennsylvanian through perforations at 4,721-33 ft. The new field is 25 miles northwest of nearest Kansas and Nebraska production. No other drilling has been done in a 3½-mile radius.

San Juan basin wells extend producing areas

Two extensions were completed in South Blanco-Dakota Cretaceous field, Rio Arriba County, northwestern New Mexico.

El Paso Natural Gas Products Co. 1 National Cooperative Refinery Association in NE NE 3-26n-7w flowed 2,800 M.c.f.d. from Dakota through perforations at 7,256-7,336 ft. This well is 1½ miles west of Dakota production.

North of the field 1 mile, El Paso 127 Rincon Unit in NE NE 28-27n-6w flowed 4,717 M.c.f.d. from Dakota through perforations at 7,364-7,586 ft. It is a dual completion with 1,499 M.c.f.d. from Mesaverde Cretaceous.

Deep New Mexico well still drilling

A 15,000-ft. wildcat in southwestern Lea County, southeastern New Mexico, was drilling below 13,145 ft. after flowing gas-condensate during drill-stem test in the lower Bend Pennsylvanian. It is Ohio Oil Co. 1 Lea Unit in 12-20s-34e, 15 miles southwest of Monument and 2½ miles southwest of Shallow Pearl field.

A drill-stem test at 13,088-13,125 ft. got 3,752 M.c.f.d. through ½-in. choke. The test was open 4 hours, surfaced gas in 14 minutes, flowing to pits for 45 minutes. The rest of the test netted 3,224 M.c.f.d. with 388 bbl. of condensate per day on 24/64-in. choke. Flow pressure ranged from 2,400 to 3,460 psi. and shut-in pressure was 6,600 psi. in 1 hour.

Earlier, a test at 12,765-12,811 ft. in upper Bend flowed 3,331 M.c.f.d. through ¾-in. choke. Recovery was 990 ft. of condensate and 20 ft. heavily oil and gas-cut mud. Flowing pressure ranged from 1,300 to 2,240 psi. Shut-in pressure was 6,920 psi. in 30 minutes. This well also indicated production in Bone Springs during drill-stem tests.

Other area news. In east-central Lea County, 10 miles southeast of Lovington, Gulf Oil Corp. is drilling below 5,386 ft. at 1 Cook in 29-16s-38e, 2½ miles southwest of Garrett field.

This well is a 9,100-ft. wildcat. A drill-stem test at 5,300-86 ft. recovered 1,540 ft. of oil, 180 ft. of heavily oil and gas-cut mud, and 60 ft. muddy water.

In the area 7 miles southeast of Maljamar in Lea County, James P. Dunigan 1 Dennus-Federal, a 9,000-ft. wildcat, found oil in the Abo reef. A drill-stem test at 8,556-96 ft. got 30 bbl. of oil per hour. Location is in Section 33-17s-33e. It is slated as a deep wildcat inside shallow Corbin field.

Rugeley field named in Matagorda County

Potential test is reported at Humble Oil & Refining Co. 1 First City National Bank of Houston, a new gas-condensate discovery in Matagorda County, Texas Gulf Coast. The well, opener of Rugeley field, is 12 miles southeast of Bay City on the M. B. Nucklo Survey, A-66, Block 15. Nearest production is 2 miles north in Old Ocean field, Brazoria-Matagorda County, line.

The well flowed 2,650 M.c.f.d. and 48.3°-gravity condensate from Frio No. 30 perforations at 13,034-68 ft. Gas-liquid ratio is 14,000:1. Shut in tubing pressure was 8,335 psi.; bottomhole shut-in pressure was 10,524 psi.

Newton County. Oil Reserves Corp. 4 Kirby-Winfrey flowed 271 bbl. of oil daily from perforations at 10,491-10,502 ft. to give Quicksand Creek field in Newton County a good well.

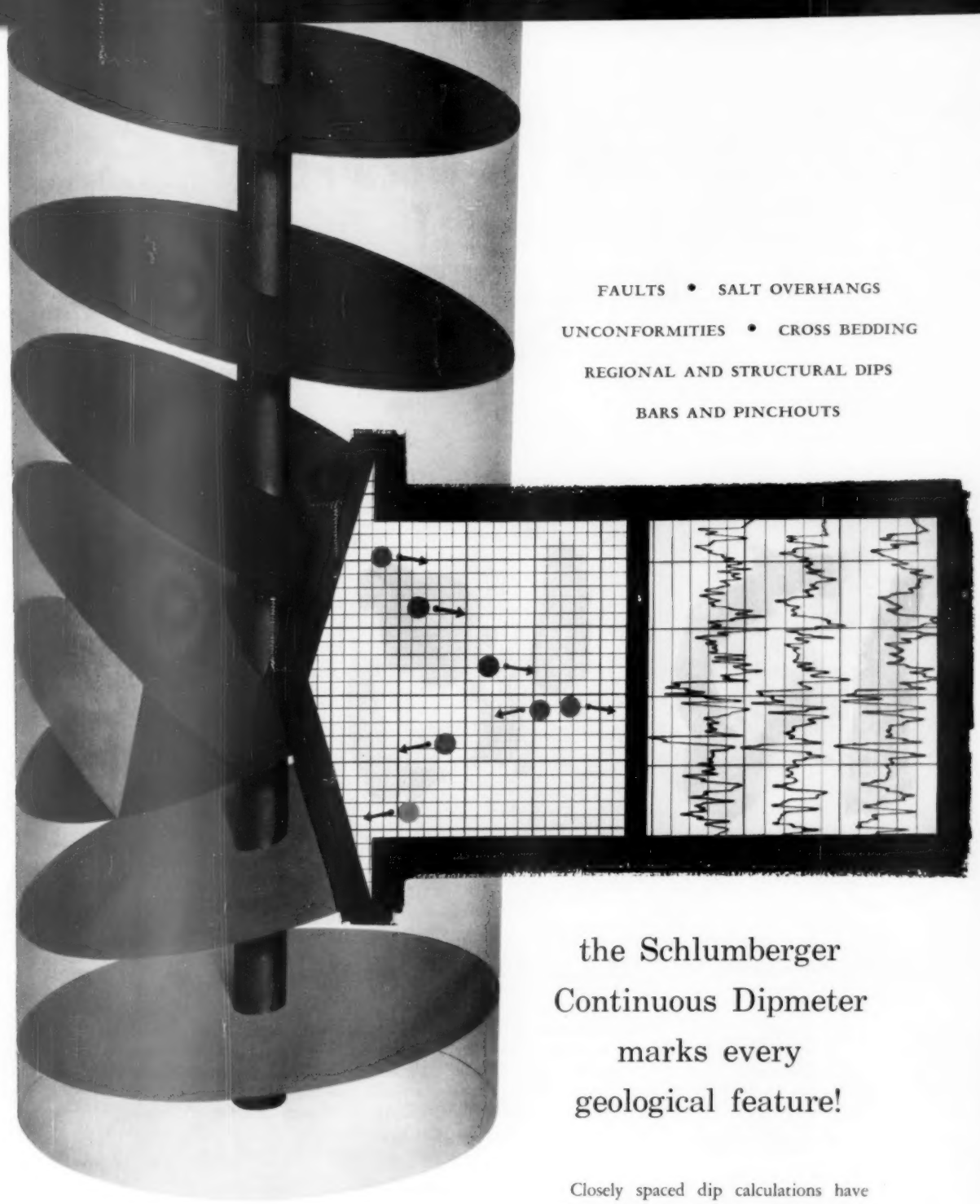
The flow as on 10/64-in. choke. The well is a confirmation to a 10,400-ft. Wilcox well opened in the field at 1 Coline. Location is 3 miles northeast of Bon Wier in the Sarah Winfrey Survey, A-508.

Texas Gulf Coast field adds new oil production

New oil production was tapped in North Blessing field, Matagorda County, Texas. The well is Texaco Inc. 3 A. B. Pierce, 1 mile west of Blessing in Josiah Tilley Survey, A-93, Block 94.

The well flowed 160 bbl. of 47.3°-gravity oil daily from F-6 Segment 2 perforations at 6,960-70 ft. Flow was on 9/64-in. choke.

Jefferson. Kilroy Co. of Texas Inc. and M. P. S. Production Co. and John W. Pace et al. 1 Doornbos Nodosaria Gas Unit 1 flowed absolute open flow of 16 M.M.c.f.d. from Nodosaria perforations at 11,840-50 ft. This good well is in Port Arthur field, Jefferson County. Gas flow had 15 bbl. condensate per 1 M.M.c.f. Location is 2½ miles north of Port Arthur in the T&NO Survey, 17, A-244.



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Remote Rio Grande wildcat slated in Texas

Edwards lime will be the objective of a remote wildcat to be drilled in Webb County, 35 miles northwest of Laredo in the Galan field area. Copano Oil Co. will drill 2-A Ed Rachal on the Joaquin Galan Grant. Objective will be 10,000 ft.

This well is 3,044 ft. northwest from southeast line of lease in Pilotes Tract, and 10,409 ft. south, 34° 21 min. west of 1-A in Galan field. Spot is about 1,200 ft. west and 15,500 ft. south from northeast corner of Survey 1837, 3,200 ft. east of Rio Grande.

The new location takes on added interest since Galan is the westernmost anchor of South Texas' Edwards trend. This places it more than 200 miles west of the easternmost point on the deep Edwards trend, recently established in Word field, Lavaca County, by Mobil Oil Co.

Oklahoma drilling centers in north, south

Northwestern and southern Oklahoma grabbed the drilling spotlight with developments of interest in several sectors.

An indicated second producer for South Whitebead field in Garvin County is Nelson and Spain Drilling Co. 1 Freeman in NW SE NE 22-3n-1w.

Recovery was 180 ft. of oil on a drill-stem test at 4,599-4,616 ft. This well offsets the 1 Isaac in C SW NE 22 which flowed 84 bbl. of oil daily on 10/64-in. choke from Second Bromide Ordovician sand at 4,636-38 ft.

Deep production is indicated at an offset well in West Criner field, McClain County. The well is Weimer & Fitzhugh 1 Whitney in C SE SW 23-6n-4w, south of the field discovery well.

Recovery was 450 ft. of oil and 30 ft. of oil-cut mud on a drill-stem test at 11,733-69 ft. in Bromide Ordovician sands. The discovery well was the 1 Hester in C W½ NE SW 23. That Bromide well flowed 421 bbl. of oil per day from 11,852-11,904 ft. on ¼-choke.

Dual production is reported at a second producer for West Flint Creek field in C SW SW 26-6n-3w. The well is Fain Porter Drilling Co. 1 Buck. It flowed 11 bbl. of oil hourly on 20/64-in. choke from Siluro-Devonian Hunton at 8,174-94 ft., and 15 bbl. in 8 hours through 20/64-in. choke from Bromide sands at 9,125-36 and 9,152-60 ft. before dying.

Northwest. The Morrow Pennsylvanian sand was good for 10,900 M.c.f.d. at Pan American Petroleum Corp. 1 Evans in C SW NE 24-2n-24eCm, on the south side of South Ridgeway field, Beaver County. The well lies just northwest of Como oil field.

At Southwest Elmwood field, Carter Division of Humble Oil & Refining Co. 1 Schlehofer in C NW NW 2-1n-23eCM, flowed 2,060 M.c.f.d. on 18/64-in. choke with 81 bbl. of oil and 9 bbl. acid water in 17 hours from Morrow perforations at 7,678-92 ft.

Shell Oil Co. 1-8 Jones-State in SW SE NW 8-2n-26eCm, South Ridgeway field, flowed 30,500 M.c.f.d. and 3 bbl. condensate per million from Tonkawa at 5,718-33 ft.

Discovery wells

COLORADO

Montezuma County:
Thomas L. Nabers Associates 2 Rowley, SW SW 6-36n-18w. IPF 29 BOPD, 30 BWPD, 328 M.c.f.d., 22/64-in. choke, TP 135 psi. Paradox "A" 5,399-5,419 ft. TD 5,719 ft. Paradox discovery, new field.

OFFSHORE LOUISIANA

Vermilion area, Vermilion Parish:
Vermilion-Blk. 101. Union Producing Co. and Mississippi River Fuel 1 OCS-0564. IPF 25 BCPD, 2,980 M.c.f.d., TP 2,500 psi. 51°, GOR 117,000:1. 7,494-7,511 ft. TD 8,075 ft. PBTD 8,032 ft. New gas discovery.

SOUTH LOUISIANA

Cameron Parish:
Texaco Inc. 1 Cameron Meadows Land, 21-14s-14w. IPF 202 BOPD, 6/64-in. choke, TP 1,600 psi., 62.2°, GOR 944:1. 8,231-41 ft. TD 10,000 ft. New oil discovery.

Jefferson Davis Parish:
California Co. 1 J. M. Pettijean, 17-11s-4w. IPF BOPD, 8,200 M.c.f.d., 18/64-in. choke, TP 8,200 psi., 57.1°, GLR 31, 284:1, 11,461-81 ft. TD 14,650 ft. PBTD 11,491 ft. Gas discovery.

MONTANA

Musselshell County:
Continental Oil Co.-American Climax 1 DeJaegher, C SE NE 31-11n-31e. IPP 177 BOPD, 33.6°, Tyler "A" sand 4,302-16 ft. TD 4,635 ft. Tyler discovery, opens North Melstone field.

NEBRASKA

Cheyenne County:
Ohio Oil Co. 1 O'Connell, NE NW SE 31-13n-50w. IPP 56 BOPD, 30% water, "J" sand discovery, new field. TD 5,073 ft.

NEW MEXICO

Chaves County:
J. F. McAdam et al. 1 Dekalb-Federal, 7 miles northeast of Roswell in 27-19s-25e. IPF 38 BOPD, ½-in. choke, 26°, San Andres 880-902 ft. TD 906 ft. New oil discovery.

San Juan County:
Redfern & Herd 1 Smith, NW SE 12-29n-13w. IPF 3,163 M.c.f.d., ¾-in. choke, SITP 1,095 psi., SICP 2,158 psi. Dakota 5,994-6,142 ft. TD 6,250 ft. New Dakota gas pool.

OHIO

Perry County:
Walsmith Drilling Co. 1 F. Walsmith, Sec. 30, Pike Twp. IPF 3,300 M.c.f.d., natural, IRP 1,080 psi. Clinton 3,220-32 ft. New gas discovery.

TEXAS PANHANDLE

Lipscomb County:
Ridgmorr Oil Co. 1 Parker, OWPD, Sec. 711, Blk. 43, H&TC Sur., 7 miles northeast of Lipscomb, IPCAOF 1,300 M.c.f.d., Cleveland 7,730-42 ft. TD 7,850 ft. New gas discovery.

SOUTH TEXAS

Bee County:
Lively & Marino 1 J. R. Dougherty Est., 6 miles southeast Beeville in H&GN Sur., A-186. IPAOF 2,700 M.c.f.d., dry, Frio 3,210-18 ft. TD 4,507 ft. New gas discovery.

Wilson County:
Forest Oil Corp. 1 Mrs. T. D. Manford et al., 8 miles southeast Stockdale in Jose F. Rodriguez Sur., A-263. IPAOF 6 M.c.f.d., lower Wilcox 4,374-79 ft. Revives old Denhawkin field. TD 4,515 ft. New gas discovery.

WEST TEXAS

Ector County:
Ashmun & Hilliard 3, Ltd. 1 Frank Cowden, 6 miles north Goldsmith in Sec. 11, Blk. 44, T-1-N, T&P Sur. IPP 33 BOPD, plus 70% water, 30.2°, GOR 200:1. San Andres 4,286-4,390 ft. TD 9,500 ft. New oil discovery.

Lubbock County:
Honolulu Oil Corp. 1 Graham Holmes, 5 miles northwest of Lubbock in Sec. 26, Blk. JS, EL&RR Sur. IPP 123 BOPD, plus 52% water, 26.2°, GOR 71:1. Clear Fork 5,566-70 etc. TD 8,120 ft. New oil discovery.

WEST CENTRAL TEXAS

Coleman County:
Daya Operating Co. 1 Lester S. West, OWWO, 4 miles northeast of Valera in Sec. 40, BBB&C Sur. IPF 260 M.c.f.d., Morris 2,570-90 ft. TD 3,137 ft. PBTD 2,917 ft. New gas discovery.

Palo Pinto County:
Pan American Petroleum Corp. 1 Ada Graves, 1 mile south of production and 3 miles southeast of Brad in SA&MG Sur. 412. IPAOF 840 M.c.f.d., Big Saline 3,631-35 ft. TD 3,970 ft. PBTD 3,654 ft. New gas discovery.

Parker County:
Lone Star Producing Co. 1 J. W. Sturdivant, 3 miles northwest of Springtown in John Montgomery Sur. A-878. IPCAOF 6,100 M.c.f.d., Bend conglomerate 5,290-5,300 ft. TD 5,900 ft. New gas discovery.

Shackelford County:
West Central Drilling Co. 1 Mrs. W. G. Green et al., 12 miles southwest of Albany in Sec. 68, Blk. 12, T&P Sur. IPF 97 BOPD, 12/64-in. choke, 39°, GOR 1,850:1, TP 500 psi., CP pkr. Gardner sand 3,669-72 ft. TD 5,005 ft. PBTD 3,698 ft. New oil discovery.

WYOMING

Campbell County:
True Oil Co. et al. 1 Wolff "D," C SE NE 35-49n-71w. IPP 125 BOPD, Minnelusa 9,971-98 ft. TD 10,030 ft. Minnelusa discovery of Southwest Timber Creek field.

Sweetwater County:
Continental Oil Co. 5-2 Unit, C NW NE 5-17n-99w. IPF 10,624 M.c.f.d., open flow, TP 50 psi. Almond 4,816-30 ft. TD 5,125 ft. Almond discovery, new field.

John G. Hurd . . . Texas independents' new chief.

TIPRO Interests to Expand

- Hurd says the association will not be restricted to state problems during his term as president.

OFFICIALS of the Interior and Defense Departments and key congressional members are apt to become much better acquainted with the Texas Independent Producers and Royalty Owners Association during the next year.

Last week some of these officials met that organization's new president, John G. Hurd, 45-year-old Laredo, Tex., independent, for the first time at a TIPRO-inspired Washington conference on the oil import-control program. (See story, p. 91).

Hurd is a tough man to handle in a debate. And it is almost certain that Washington will get more than just this one look at his talent in this field.

For in his first official words early in May as TIPRO president, the good-looking Texan told his fellow members that the association under his administration would not restrict itself solely to state problems. TIPRO, he pointed out, has a membership comparable to that of any association of independents in the country. In a broad hint of what is to come, Hurd said, "TIPRO does not and will not recognize any jurisdictional boundaries."

A wise choice . . . It would have been hard for the association to have found a man better qualified to do some scrapping in the nation's capitol if that is its aim.

For one thing, Hurd knows the legal ropes. He is a graduate of the Harvard University Law School (class of 1937) and was a practicing attorney before leaving that profession for the oil business.

Following service from 1941-45 during World War II as a naval intelligence officer on fleet duty in the Atlantic and Mediterranean theaters, Hurd joined Radcliffe Killam in an oil partnership which they still operate as Killam & Hurd.

He has since expanded into oil gathering as a vice president of Texpata Pipe Line Co. and has acquired substantial ranching interests.

The South Texan has a world of poise. He speaks clearly and easily in a surprisingly deep bass voice.

As chairman last year of TIPRO's natural-gas committee, he is not unaware of the pitfalls and frustrations in trying to accomplish something in Washington.

He has been a member of the executive committee of TIPRO since 1957.

Also a member of the Texas Mid-Continent Oil and Gas Association, he has served that organization as a director since 1949.

Hurd has been almost constantly active on behalf of civic and charitable organizations and his church. He was president of the Laredo Community Chest in 1948-49, president of the Laredo Chamber of Commerce from 1955-57, a chapter chairman of the American Red Cross in 1954, and has served as an executive committee member of the Gulf Coast Council of the Boy Scouts of America since 1956.

Along with his other business interests, he is a director of the Laredo Savings and Loan Association and of a Laredo bank.

▶▶▶ Personals

Burnett J. Schulz has been named laboratory liaison manager of Mobil International Oil Co.'s products research and planning department. He has been technical director of the products service section at Mobil's Paulsboro, N. J., laboratory.

Frank P. Troseth, district geophysicist in New Orleans for Mobil Oil Co., has been named district exploration superintendent in Roswell, N. M.

Preston G. Rennie, district engineer with Sohio Petroleum Co. in Pauls Valley, Okla., has been promoted to head of the operations engineering section for Sohio in Oklahoma City.

Sidney M. Brunson has been named project manager for engineering and construction of the new ethylene dichloride plant of C.S.R.C.-Dow Pty., Ltd., in Melbourne, Australia. Brunson has been assistant production superintendent of the vinyl-vinylidene chloride department in Dow Chemical's Texas division.

Lawrence A. Kimpton, chancellor of the University of Chicago, will join Standard Oil Co. (Ind.) as soon as a successor is elected by the university. Kimpton will undertake special assignments for Indiana Standard. He has been a director of the company since 1958.

H. L. Keller, senior assistant division manager for Phillips Petroleum Co.'s St. Louis sales division, has been appointed manager. He succeeds **Willard R. Johnson,** who has been named consultant for the division.

▶▶▶ Personals

John W. Green, assistant general sales manager, domestic sales department, for Texaco Inc., has been elected vice president in charge of domestic sales. He succeeds **I. G. Morgan,** who has been transferred to Los Angeles as vice president and assistant to **James T. Wood, Jr.,** Texaco's senior vice president on the West Coast.

GREEN

MORGAN

Green has been with the company since 1935 and has served as Houston division sales manager, southern regional sales manager, and northern regional sales manager. Morgan was assistant general sales manager of the Pacific Coast region and general manager of the sales department in Los Angeles before being elected vice president in January.

F. Drake Parker, vice president of Arthur G. McKee & Co., has been appointed managing director of McKee Head Wrightson, Ltd., with headquarters in London. **Douglas H. Carter,** director and general manager of Head Wrightson Processes, Ltd., has been appointed director and general manager of McKee Head Wrightson, which is jointly owned by Arthur G. McKee & Co. and Head Wrightson & Co., Ltd.

Trunkline Gas Co. has named three district managers of exploration, a new post in the production and gas supply department. The new managers are **Raymond E. Fairchild,** Houston district; **Robert H. Dickerson,** Corpus Christi, Tex., district; and **Wallace K. Cox,** Lafayette, La., district.

L. R. Newfarmer, Pacific Coast area exploration manager for Shell Oil Co., has been appointed exploration manager in charge of special investigations not assigned to the exploration and production areas. He will headquarter in Houston. Newfarmer has been with Shell since 1936. He was exploration manager in Houston before moving to Los Angeles. The new appointment is effective June 15.

Carl R. Temple, district superintendent for Sohio Petroleum Co. in Centralia, Ill., has joined Mississippi River Fuel Corp. in St. Louis as superintendent of gas storage.

Harry Miller, assistant regional manager of production for Continental Oil Co. in Oklahoma City, has been promoted to central region manager of production. He succeeds **R. G. Parker,** who was promoted to assistant general manager of the central region last week. Miller and Parker will continue to headquarter in Oklahoma City.

C. F. Martineau, special assistant to the general manager in Shell Oil Co.'s head office marketing department, has been named manager of the Detroit marketing division.

Paul V. Hodge, equipment manager for Geophysical Service, Inc., has been appointed head of the company's marine operations with headquarters in London. **Jack V. McManus,** chief field service engineer, will succeed Hodge as equipment manager. McManus will continue to headquarter in Dallas. **A. L. Sackery** will succeed McManus. **Carl O. Jackson,** Calgary, has been transferred to Dallas as mechanical equipment supervisor.

A. C. Polk has been named president of Dowell of Canada, Ltd., succeeding **John G. Staudt.** Polk is also executive vice president and general manager of Dow Chemical Co.'s Dowell Division. **W. R. Graves** will continue as executive vice president and general manager of Dowell of Canada.

Jorge Mejia has been appointed Mobil International Oil Co. regional executive for Central America, the Pacific Coast nations of South America, and Argentina. **Howard Bird, Jr.,**

MEJIA

BIRD

formerly a regional executive for Latin America, has been appointed regional executive for Germany, Holland, and Belgium.

Ray R. Hawthorne has been named regional gas supervisor for Atlantic Refining Co.'s Texas Gulf Coast Region. He succeeds **William H. Hogan,** who was named Mid-Continent regional gas supervisor several months ago. **Thomas J. McBryde,** assistant to the area geologist in Dallas, will succeed Hawthorne as administrative assistant to the regional manager, Texas Gulf Coast region.

Gordon W. Jones, manager of technical services for M. W. Kellogg Co., has been appointed assistant vice president and director of construction. He will be responsible for all construction activities in North and South America and for development of construction methods. Jones joined Kellogg in 1929. He has been resident manager on many Kellogg projects including an Australian refinery and a refinery complex in Scotland. He formerly was construction manager of Kellogg International Corp., Ltd., London.

Herbert Willetts, president of Mobil Oil Co. and executive vice president of Socony Mobil Oil Co., Inc. and **W. R. Stott,** vice president of Standard Oil Co. (N. J.), have been elected directors of American Petroleum Institute. **Morgan J. Davis,** president of Humble Oil & Refining Co., has been elected to the API executive committee. Davis has been a director since 1957. Willetts succeeds **R. L. Minckler,** retired senior vice president of Mobil, on the API board. Stott succeeds **Eugene Holman,** retired Jersey Standard chairman.

Millard Temple, Tidewater Oil Co., has been named chairman of the new South Louisiana chapter of Natural Gasoline Association of America. Other officers are **Russell Abernathy,** Amerada Petroleum Corp., vice chairman, and **David S. Morse,** Ingersoll-Rand Co., secretary-treasurer. The executive board also includes **W. R. Brown,** Texaco Inc.; **Robert M. Hippard,** Shell Oil Co.; **Dr. Z. I. Loflin,** Southwestern Louisiana Institute and Computing-Research Associates; **George Caraway,** Atlantic Refining Co.; **D. D. Jones,** Cameron Iron Works; and **Walter Taber,** Clark Brothers Co. First meeting of the group was to be held Monday, May 16.

L. W. Stoesz, exploration manager in Shell Oil Co.'s Casper, Wyo., division, has been named Oklahoma division exploration manager. He succeeds **G. H. Thompson,** who has been transferred to Denver as area geologist.

Robert L. Evans, junior gas engineer with Atlantic Refining Co. in Dallas, has joined Allied Chemical Corp.'s solvay division in Baton Rouge, La., as process engineer.

Management Changes Made by Sunray Companies

A NEW LINE UP of top Sunray Mid-Continent Oil Co. and DX Sunray Oil Co. officers was named by directors last week. C. H. Wright, left, Sunray chairman, has stepped down to become chairman of the finance committee. R. W. McDowell, center, Sunray vice chairman and DX Sunray president, has succeeded Wright as chairman of the parent company. Stanley D. Breitweiser, standing, right, executive vice president of DX Sunray, has succeeded McDowell as president. Paul E. Taliaferro, right, has been reelected president and chief executive officer of Sunray. W. C. Whaley, standing, left, has been reelected chairman of Sunray's executive committee. Three new sales vice presidents were named by DX Sunray after Breitweiser's election. They are N. B. Ingram, retail sales; Floyd L. Miles, wholesale marketing; and Frank B. Fulenwider, products supply and transportation.

J. A. Vickers, president of Vickers Petroleum Co.; **C. Y. Thomas,** chairman, Spencer Chemical Co.; and **R. L. Wagner,** administrative vice president of Great Lakes Pipe Line Co., have been elected to the executive committee of Midwest Research Institute. **Harry Moreland,** president of Great Lakes Pipe Line Co., is an ex officio member of the committee. **Dr. Nat C. Robertson,** vice president, Spencer Chemical, has been elected a trustee of the Institute. Moreland, Thomas, and **L. L. Dresser,** president of Dresser Engineering Co., have been reelected trustees.

Dr. Kenneth Johnson, director of acrilan manufacturing for Chemstrand Corp., has been named director, research administration, for Chemstrand Research Center, Inc. **Louis D. Scott,** manufacturing manager of Chemstrand's Decatur, Ala., acrylic fiber plant, will succeed Johnson.

Hamilton P. Dendel, assistant to the executive vice president of Standard Oil Co. (Ind.), has been appointed district manager in Rochester, N. Y., for American Oil Co.

C. G. Goss, a senior design and construction engineer for Phillips Petroleum Co., has been named chief engineer for Phillips Pipe Line Co. **D. W. Calvert,** senior design and construction engineer, has been appointed assistant to the manager of Phillips Petroleum's supply and transportation department.

C. James Bulla, staff assistant in the gas-purchase division of Northern Natural Gas Co.'s gas-supply department, has been appointed gas buyer, a new position. **James P. Coyle** and **Richard L. Torczon,** gas-purchase engineers, also have been named gas buyers.

Tom Hopson, engineer in Service Pipe Line Co.'s Tulsa electrical section, has been transferred to the East Texas division as an engineer. He will headquarter in Fort Worth. Hopson succeeds **J. C. Peard,** who recently was transferred to Baytown, Tex.

Alvin M. Hutchison, manager of transmission for Ohio Fuel Gas Co., has been elected a vice president of the company. Hutchison has been with Ohio Fuel since 1930. He was named transmission manager in January.

▶▶▶ Personals

L. H. True, president of Magnolia Pipe Line Co., has been elected a vice president and reelected a director of South Saskatchewan Pipe Line Co., Regina. South Saskatchewan is partially owned by Mobil Oil of Canada. **Ross Madole,** general attorney for Magnolia Pipe Line, has been elected vice president and a director of South Saskatchewan. **E. J. Wacker, Jr.,** vice president of Magnolia, has been elected a director.

A. G. Prasil has been named chief engineer for Southern Union Gas Co. He will be in charge of engineering operations in the company's gathering, processing, transmission, and distribution systems in Texas, New Mexico, Arizona, and Colorado. Prasil joined Southern Union in 1958 as engineer.

Arthur W. Manley, vice president and secretary of Mississippi River Fuel Corp., has been elected executive vice president of the pipeline division.

M. W. Patterson, retail sales manager in Chicago for Cities Service Oil Co., has been named Chicago regional sales manager. He succeeds **James M. Ross,** who has retired after 36 years with the company. **F. L. Thorne** will succeed Patterson.

Dr. H. F. Harnsberger has been appointed supervising research chemist in the petroleum process research section at California Research Corp.'s Richmond, Calif., laboratory.

Joseph K. Roberts, retired director and vice president of Standard Oil Co. (Ind.), has been elected a director of Scientific Design Co., Inc., New York. He also will be a consultant to the company, which designs and builds chemical plants. Roberts was vice president, research and development, for Indiana Standard before his retirement earlier this year.

Dr. George A. Weisgerber and **Richard O. Adams** have been named research associates by Esso Research & Engineering Co. Adams, now on special assignment with Standard Oil Co. (N. J.), will be in Esso Research's marketing technical division as area contact for affiliated companies in North America and the Caribbean. Weisgerber will be in the products research division.

Personals

Clifford B. Marshall, vice president, a director, and vice chairman of the executive committee of Standard-Vacuum Oil Co., has been elected executive vice president. He is first to hold this title with Stanvac. **J. W. Gwinn** has been named head of exploration activities for Stanvac succeeding **George F. Barnwell,** who has

MARSHALL

GWINN

retired. Marshall was general manager in charge of marketing operations in India, Pakistan, Burma, and Ceylon at one time. He later was chief negotiator of an agreement with the Government of India to build a $35-million refinery in Bombay. Gwinn joined Stanvac in 1947 as chief geologist in Indonesia after serving with other Standard Oil Co. (N. J.) affiliates in the U. S., Latin America, and Cuba.

C. W. Couser, district geologist in charge of the Fort Smith, Ark., office of Humble Oil & Refining Co.'s Carter Division, has been named district exploration manager in Pittsburgh. The appointment is effective June 1.

Gus G. Douglas, area engineer for Texaco Inc., in Winfield, Kans., has been promoted to production foreman in McLeansboro, Ill.

Bob Stuard, drilling superintendent of Coral Drilling Co., Inc., has been elected a vice president of the company.

L. R. Mills, vice president and treasurer of Crown Central Petroleum Corp., has been elected a director of the company.

G. E. Burpee, manager of Shell Oil Co.'s Houston area production department, has been named assistant to the vice president in Houston. The appointment is effective June 1.

P. L. Dana, vice president of J. M. Huber Corp., will be in charge of the company's new oil and gas division headquarters in Denver. The division office will be moved to Denver from Borger, Tex., June 1.

V. C. Davis has been appointed supervising research engineer, instrument development and maintenance, in the general services division of California Research Corp.'s Richmond, Calif., laboratory.

H. V. Aiguier, tool pusher with Helmerich & Payne, Inc., has been transferred to Ozona, Tex., from Lovington, N. M.

Paul S. Ache, Jr., area engineer with United Producing Co., Inc., in Denver, has been promoted to senior petroleum engineer in Houston.

W. F. Robertson, district geologist with Pure Oil Co., has been transferred to Durango, Colo., from Billings, Mont. He will be succeeded in Billings by **R. A. Saunders.**

Burdette A. Ogle has resigned as executive vice president of Cabeen Exploration Corp. to form Ogle Corp., Denver. He will continue as a consultant to Cabeen.

Anthony R. Ciuffreda has been appointed engineering associate by Esso Research & Engineering Co.

P. S. Magruder has been named assistant to the president of Mobil Oil Co. He will headquarter in Los Angeles and will be concerned mainly with the Pacific Coast area. Magruder was executive vice president of General Petroleum Corp. before it was merged with Mobil. Magruder also will be proposed by Mobil to fill the vacancy on the board of Western Oil and Gas Association created by retirement of **Robert L. Minckler,** Mobil senior vice president. Minckler's retirement, announced earlier, became effective May 1.

MAGRUDER

G. B. McGillivray, manager of Canadian Petroleum Association's Saskatchewan division, will head the association's new liaison office in Victoria, B. C. The office will open June 1.

Dwain C. McCoy, lease foreman for Shell Oil Co. in Great Bend, Kans., has been promoted to production foreman in Glendive, Mont.

C. E. Wilson, production foreman for Continental Oil Co., has been transferred to Cherokee, Okla., from Wewoka, Okla.

Harry A. Wahl, Jr., has joined Continental Oil Co.'s research division as research engineer, well-engineering section.

R. D. Coles, Jr., exploitation engineer with Shell Oil Co., has been transferred to Los Angeles from Farmington, N. M.

Deaths

George Frederick von Bieberstein, 57, a refinery supervisor for Arabian American Oil Co. in Ras Tanura, Saudi Arabia, died May 2 in Ras Tanura after a heart attack. Von Bieberstein was with Texaco Inc. in West Tulsa before joining Aramco.

Claude Speir, 50, production superintendent for S. D. Jarvis Co., died May 1 in an Olney, Ill., hospital.

Rowell A. Billups, 61, founder of Billups Eastern Petroleum Co. and Billups Western Petroleum Co., independent marketing firms, died May 9 in Baton Rouge, La.

Norman G. Davidson, retired vice president of Golden Bear Oil Co., died May 5 in Glendale, Calif., after a long illness.

John Louis Puterbaugh, 80, retired vice president of the old Trinity Cotton Co., died May 6 in Dallas after a heart attack.

Herman W. Mayhew, 81, chairman of Mayhew Machine Co., Inc., and Mayhew Supply Co., Dallas, died May 10 in Dallas. Mayhew was a pioneer in development of portable drilling rigs for geophysical work. The Mayhew companies, currently among the country's major manufacturers and suppliers of geophysical rigs, grew from a small machine shop Mayhew opened in Dallas in 1923.

Benjamin W. Nedbalek, 51, division manager and a director of Texaco-Cities Service Pipe Line Co., died May 11 in a Tulsa hospital. Nedbalek moved to Tulsa from Dallas in 1941. He had been with the company and its affiliates for 24 years.

California holds top place in gasoline sales

BY JOHN C. CASPER

A quick look at the highlights . . .

	LATEST WEEK	Change from WEEK AGO		Change from YEAR AGO	
Production	6,791,550	DOWN	227,605	DOWN	437,420
Crude stocks	262,694,000	UP	769,000	UP	7,667,000
Completions	803	UP	54	DOWN	225
Refinery runs	7,788,000	DOWN	157,000	UP	66,000
Gasoline stocks	218,772,000	DOWN	752,000	UP	10,353,000
Kerosine stocks	21,468,000	UP	1,444,000	DOWN	148,000
Distillate stocks	83,501,000	UP	2,126,000	DOWN	4,154,000
Residual stocks	38,705,000	DOWN	615,000	DOWN	16,848,000
Four product stocks	362,446,000	UP	2,203,000	DOWN	10,797,000
Total imports	1,672,200	DOWN	65,900	UP	298,200

CALIFORNIA AGAIN LED all states last year in sales of gasoline. This state also reported the largest volumetric gain over 1958. The largest percentage gain also was on the West Coast. Gasoline sales in Washington were up 13.1%.

Data for the table are compiled each year by the Department of Statistics of the American Petroleum Institute from information supplied by tax departments of the various state governments. The figures reflect, as nearly as is possible to determine it, gasoline consumption by states. The totals include all gasoline whether sold for taxable or tax-exempt purposes.

Original API figures are in gallons per year. Data for the table on this page have been converted to barrels daily for easier comparison with Bureau of Mines totals.

Total domestic gasoline demand, reported by the Bureau of Mines, averaged 4,054,000 bbl. daily for 1959. Total gasoline consumption reported by API was 4,001,000 bbl. daily. Most of the difference is accounted for by the products covered in the two series. Gasoline demand reported by the bureau includes naphtha, most of which would not be classified as gasoline by state tax departments.

There was no change in the order of the top 10 gasoline-consuming states last year. But California increased its lead over second-place Texas. California sales topped Texas by 88,000 bbl. daily last year compared with 68,000 bbl. daily in 1958.

Sales in Florida have shown excellent gains over the past few years. This state was in eleventh place in 1956. It crowded Missouri out of tenth place in 1957 and moved up another notch to take ninth place from Indiana in 1958. Florida sales in 1959 were 8,350 bbl. daily behind eighth-place New Jersey, compared with a difference of 20,325 bbl. daily in 1956. This growth in Florida's gasoline demand is attracting the attention of marketing departments in many oil companies.

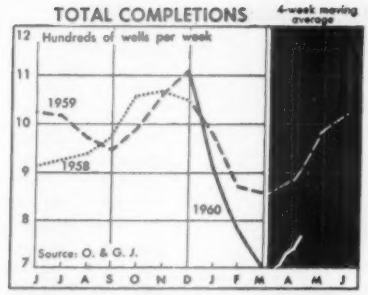
Sales in Districts 1 and 2 accounted for 69.9% of the national total last year. Ratios for two previous years were 71.5% and 70.2%.

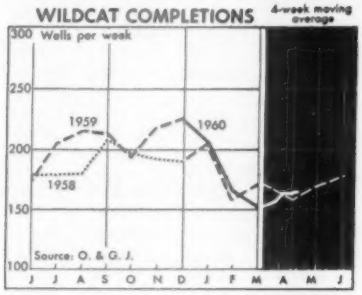
Three states reported lower sales in 1959 than in 1958. North Dakota was down 1,003 bbl. daily or 4.8%. Sales in New Mexico decreased 761 bbl. daily or 2.6%. Texas was off 7,548 bbl. daily or 2.5%.

GASOLINE CONSUMPTION BY STATES

(Barrels daily)

	1956	1957	1958	1959
Connecticut	45,118	47,333	48,199	50,183
Delaware	10,117	12,049	12,226	13,295
Dist. of Columbia	13,288	12,917	12,921	13,518
Florida	99,770	109,206	114,946	122,615
Georgia	76,071	77,951	80,421	84,677
Maine	19,490	20,451	20,921	21,669
Maryland	53,348	54,483	56,119	58,916
Massachusetts	82,353	86,490	88,362	92,973
New Hampshire	12,011	12,854	12,861	13,229
New Jersey	120,095	120,694	124,429	130,965
New York	241,350	255,967	260,974	268,354
North Carolina	85,343	87,169	89,280	95,355
Pennsylvania	194,458	203,104	207,133	212,524
Rhode Island	15,277	15,807	16,059	16,228
South Carolina	43,205	43,943	45,030	47,672
Vermont	7,918	8,073	8,235	8,567
Virginia	77,991	80,889	82,459	86,256
West Virginia	31,395	32,765	32,412	34,411
Total District 1	1,228,598	1,282,145	1,312,987	1,371,406
Illinois	183,073	189,817	192,495	197,866
Indiana	111,743	112,195	111,547	117,197
Iowa	72,765	73,510	76,695	77,749
Kansas	67,627	67,513	67,869	69,033
Kentucky	53,196	56,393	56,838	59,295
Michigan	161,691	167,314	168,116	174,273
Minnesota	78,211	80,869	85,093	86,625
Missouri	104,207	104,591	107,647	113,072
Nebraska	37,016	37,928	38,942	40,330
North Dakota	19,809	20,498	20,947	19,944
Ohio	199,751	204,116	203,586	212,121
Oklahoma	61,391	61,292	65,730	71,287
South Dakota	21,250	21,870	22,363	22,674
Tennessee	67,459	69,459	72,307	77,477
Wisconsin	78,987	81,108	83,946	86,381
Total District 2	1,318,176	1,348,473	1,374,121	1,425,324
Alabama	57,690	59,442	61,691	64,869
Arkansas	35,939	35,722	37,163	38,752
Louisiana	57,027	59,318	61,347	62,977
Mississippi	39,686	39,429	40,572	43,257
New Mexico	24,368	26,417	28,966	28,205
Texas	292,473	287,886	306,932	299,384
Total District 3	507,183	508,212	536,671	537,444
Colorado	41,514	43,239	44,628	46,525
Idaho	16,618	16,964	17,704	18,305
Montana	18,931	18,921	19,084	20,005
Utah	19,699	20,394	21,321	22,474
Wyoming	10,656	10,912	11,058	11,676
Total District 4	107,418	110,430	113,795	118,985
Arizona	25,396	27,385	29,516	31,895
California	346,971	356,276	374,626	387,773
Nevada	8,400	8,825	9,000	9,829
Oregon	41,714	41,331	42,128	44,015
Washington	60,590	62,231	65,883	74,450
Total District 5	483,071	496,048	521,153	547,962
Total U. S.	3,644,446	3,745,308	3,858,727	4,001,121





Active Rotary Rigs

	5-9-60	5-2-60	5-11-59
Alabama	5	3	7
Alaska	5	5	(†)
Arkansas	12	11	12
Arizona	2	3	1
California	96	96	98
Land	91	91	94
Offshore	5	5	4
Colorado	25	28	26
Florida	1	1	3
Land	1	0	2
Offshore	0	1	1
Illinois	48	54	42
Indiana	10	9	10
Iowa	0	0	3
Kansas	117	115	146
Kentucky	4	6	9
Louisiana	273	280	346
North	33	33	30
S. Inland waters	112	112	150
S. Land	75	78	121
Offshore	53	57	45
Maryland	0	0	0
Michigan	35	29	22
Mississippi	57	70	55
Missouri	2	1	0
Montana	14	20	22
Nebraska	23	20	26
Nevada	0	0	0
New Mexico	124	122	106
New York	1	1	1
North Dakota	13	14	40
Ohio	4	4	3
Oklahoma	184	191	247
Oregon	1	0	0
Pennsylvania	12	15	12
South Dakota	0	0	2
Texas	632	629	795
S. Inland waters	11	11	6
S. Land	162	156	185
Offshore	1	1	0
North	43	43	176
Panhandle	49	50	(*)
East	63	61	(*)
West Central	196	188	273
West	107	119	155
Utah	25	24	26
Washington	0	0	0
West Virginia	3	3	7
Wyoming	59	55	71
Total U. S.	1,787	1,809	2,138
Western Canada	92	85	121
Eastern Canada	2	2	0
Grand Total	1,881	1,896	2,259

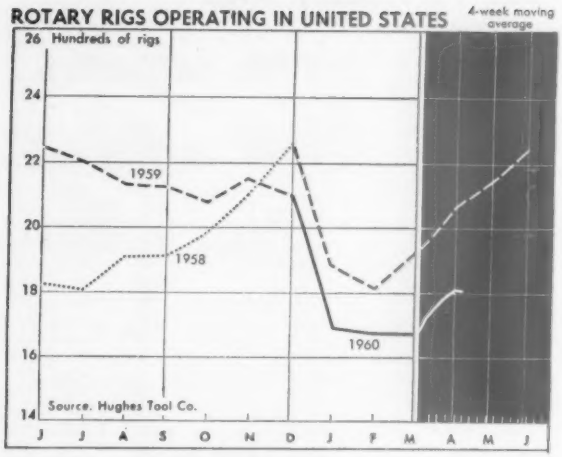
Hughes Tool Co. report. *Included in North. †Data first reported 4-4-60. Comparisons not available due to change in method of reporting.

WEEKLY WELL COMPLETIONS . . . WEEK ENDED MAY 7, 1960

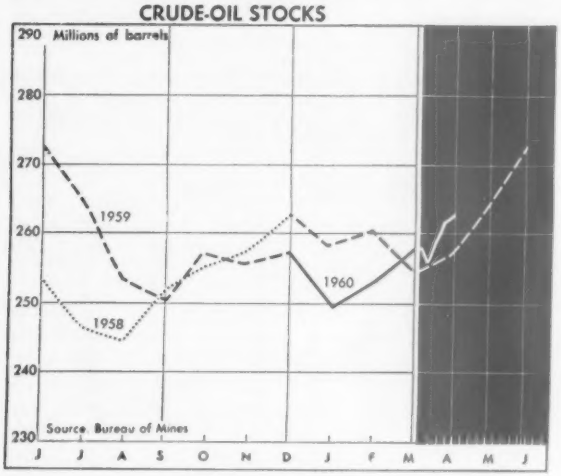
	Total wells							Cum.		Total wildcats					Cum.	
	Total	Crude	Cond.	Gas	Dry	Service	Footage	1960	1959	Total	Crude	Cond.	Gas	Dry	1960	1959
Alabama	3	3	0	0	0	0	34,601	20	38	0	0	0	0	0	1	5
Arizona	0	0	0	0	0	0	0	6	...	0	0	0	0	0	6	...
Arkansas	8	4	0	1	3	0	32,520	211	304	3	1	0	0	2	54	52
California	28	17	0	2	9	0	132,124	454	538	8	1	0	0	7	102	124
Colorado	14	2	0	3	9	0	79,400	238	250	7	0	0	0	7	112	148
Illinois	29	4	0	0	25	0	58,391	652	730	3	0	0	0	3	162	125
Indiana	19	8	0	1	10	0	22,770	308	232	6	0	0	1	5	124	78
Kansas	66	25	0	2	36	3	222,468	1,068	1,409	16	1	0	0	15	354	315
Kentucky	9	3	0	0	6	0	14,464	562	576	1	1	0	0	0	68	58
Louisiana	60	32	10	1	17	0	579,029	1,120	1,225	8	0	1	0	7	170	153
North	10	8	0	0	2	0	35,337	344	434	1	0	0	0	1	68	68
South	40	20	7	1	12	0	430,758	583	661	7	0	1	0	6	90	81
Offshore	10	4	3	0	3	0	112,934	193	130	0	0	0	0	0	12	4
Michigan	9	5	0	1	3	0	30,793	246	195	1	0	0	0	1	77	50
Mississippi	8	2	0	0	6	0	77,621	270	235	3	0	0	0	3	86	107
Montana	5	1	0	0	4	0	24,312	81	102	2	0	0	0	2	39	39
Nebraska	27	13	0	0	14	0	152,822	281	269	11	0	0	0	11	111	122
New Mexico	30	21	1	5	3	0	139,639	635	619	2	0	0	0	2	87	67
West	12	5	1	5	1	0	61,133	215	269	1	0	0	0	1	20	19
East	18	16	0	0	2	0	78,506	420	350	1	0	0	0	1	67	48
New York	22	13	0	0	2	7	29,700	122	122	0	0	0	0	0	7	12
North Dakota	6	4	0	0	2	0	38,883	106	163	1	1	0	0	0	18	36
Ohio	18	5	0	3	10	0	52,230	371	331	3	0	0	1	2	19	9
Oklahoma	78	38	2	12	24	2	321,287	1,296	2,100	16	3	0	1	12	243	323
Pennsylvania	0	0	0	0	0	0	0	185	163	0	0	0	0	0	7	3
South Dakota	0	0	0	0	0	0	0	15	...	0	0	0	0	0	6	...
Texas	335	182	13	15	116	9	1,370,649	5,606	6,737	67	7	1	1	58	1,139	1,267
Dist. 1	16	11	1	1	3	0	48,890	403	417	3	0	0	0	3	138	107
Dist. 2	26	8	0	6	12	0	137,891	256	294	6	0	0	0	6	61	82
Dist. 3	28	11	2	1	14	0	175,356	434	393	3	0	0	0	3	80	92
Dist. 4	33	10	4	1	18	0	166,325	420	426	13	1	0	0	12	123	117
East	25	19	2	0	4	0	102,288	420	397	5	0	1	0	4	86	82
Dist. 7-B	56	23	1	3	29	0	135,010	829	932	14	0	0	1	13	240	248
West	71	52	2	2	13	2	358,284	1,470	2,093	11	3	0	0	8	234	258
Dist. 9	60	35	1	0	18	6	143,660	1,022	1,280	12	3	0	0	9	152	238
Dist. 10	20	13	0	1	5	1	102,945	352	505	0	0	0	0	0	25	43
Utah	9	5	0	0	4	0	49,169	105	130	3	0	0	0	3	38	36
West Virginia	0	0	0	0	0	0	0	258	246	0	0	0	0	0	2	6
Wyoming	19	8	0	2	9	0	92,560	330	285	8	1	0	0	7	138	92
Misc. (Mo.)	1	0	0	0	1	0	3,390	26	23	1	0	0	0	1	24	18
Total U. S.	803	395	26	48	313	21	3,558,822	14,572	17,022	170	16	2	4	148	3,194	3,245
Prev. week	749	364	19	50	291	25	3,405,227	.....	.....	158	16	0	2	140	.....	.....
Cum. 1960	14,572	6,829	475	1,188	5,665	415	64,368,891	.....	.....	3,194	283	34	98	2,779	.....	.....
Cum. 1959	17,022	8,613	443	1,204	6,312	450	71,534,605	.....	.....	3,245	327	46	105	2,767	.....	.....
Western Canada	41	23	0	6	12	0	263,585	812	822	0	0	0	0	0	248	308

PRODUCTION

ROTARY RIGS OPERATING IN UNITED STATES



CRUDE-OIL STOCKS



CRUDE-OIL STOCKS BY STATES OF ORIGIN*

(Thousands of barrels)

	4-30-60	4-23-60	5-2-59
Pennsylvania	2,116	2,119	2,457
Other Appalachian	1,734	1,647	1,585
Illinois, Indiana, Michigan	9,329	9,451	9,119
Nebraska and North Dakota	2,793	2,685	2,172
Kansas	9,989	9,785	9,450
Oklahoma	17,902	17,512	16,414
Arkansas	2,116	2,255	1,854
Louisiana	19,579	18,957	18,583
North	3,246	3,172	3,293
South	16,333	15,785	15,290
Mississippi, Alabama, Florida	2,327	2,282	2,353
New Mexico	7,878	7,510	7,609
Texas	113,436	113,685	111,653
East Texas	8,603	8,742	8,811
West Texas	51,308	50,959	53,593
Texas Gulf	19,991	21,053	17,732
Other Texas	33,534	32,931	31,517
Wyoming	17,600	17,708	14,372
Other Rocky Mountain	9,348	9,757	9,222
California	29,255	29,256	33,681
Foreign	†17,292	17,316	14,503
Total	**262,694**	261,925	255,027

*Bureau if Mines. †Includes 4,223,000 bbl. in California.

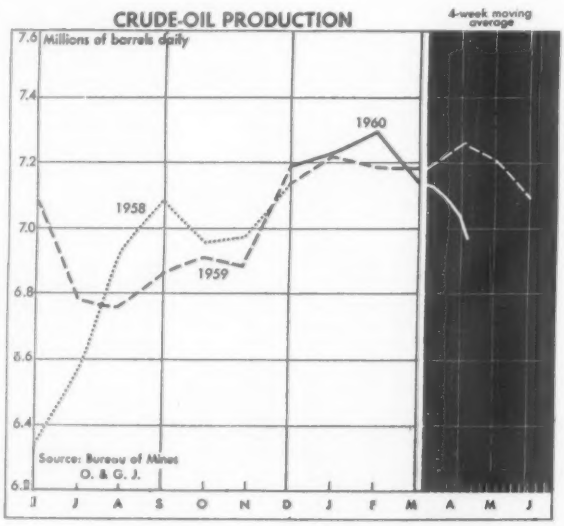
DAILY AVERAGE PRODUCTION FOR WEEK

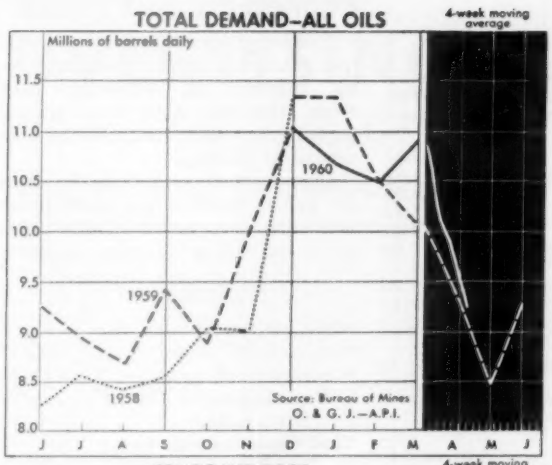
	May 7, 1960			
	Crude oil	Lease condensate	Total	Apr. 30 total
Alabama	19,400	.....	19,400	19,350
Arkansas	82,700	150	82,850	82,800
California	830,600	.....	830,600	829,400
Colorado	129,400	.....	129,400	129,000
Eastern	41,600	.....	41,600	40,300
Florida	1,000	.....	1,000	1,100
Illinois	220,800	.....	220,800	212,800
Indiana	32,600	.....	32,600	32,500
Kansas	†287,700	.....	†287,700	†308,930
Kentucky	64,300	.....	64,300	64,300
Louisiana	914,775	134,725	1,049,500	1,103,000
North	104,775	6,225	111,000	115,000
South	810,000	128,500	938,500	988,000
Michigan	32,700	.....	32,700	32,700
Mississippi	137,000	3,600	140,600	134,400
Montana	81,000	.....	81,000	80,000
Nebraska	62,000	.....	62,000	61,800
Nevada	100	.....	100	100
New Mexico	293,000	7,000	300,000	312,000
North Dakota	59,000	.....	59,000	58,100
Oklahoma	†513,200	.....	†513,200	†544,400
Texas	2,326,000	89,900	2,415,900	2,551,175
Dist. 1	40,000	3,000	43,000	45,200
Dist. 2	98,000	8,000	106,000	118,600
Dist. 3	306,000	39,000	345,000	349,000
Dist. 4	159,000	18,000	177,000	192,800
Dist. 5	26,000	400	26,400	28,000
Dist. 6	98,000	9,800	107,800	115,800
East Texas field	120,000	.....	120,000	132,000
Dist. 7-B	121,000	175	121,175	122,450
Dist. 7-C	114,000	2,825	116,825	123,325
Dist. 8	944,000	6,000	950,000	1,022,300
Dist. 9	193,000	1,700	194,700	193,600
Dist. 10	107,000	1,000	108,000	108,100
Utah	88,000	.....	88,000	103,500
Wyoming	338,000	.....	338,000	336,100
Others	‡1,300	.....	‡1,300	‡1,400
Total U. S.	6,556,175	235,375	**6,791,550**	7,039,155
Change from previous week, down			**247,605**	
Canada	†451,600	.....	†451,600	‡506,400

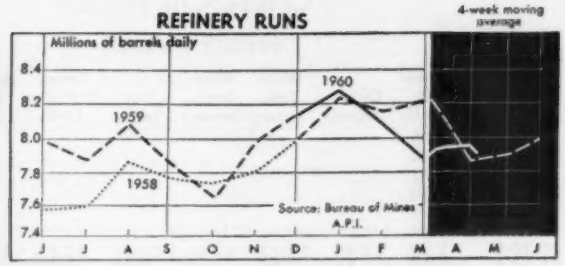
Total U. S. production—Jan. 1-May 7 ..... 914,263,900 bbl.
Same period last year (crude plus cond.) ..... *916,316,200 bbl.

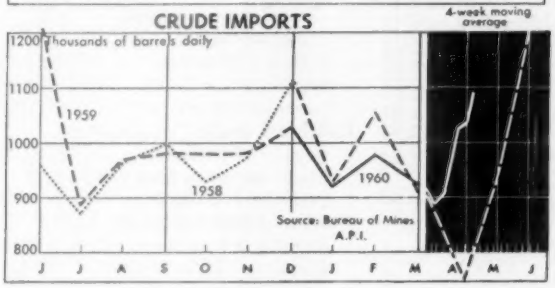
*Includes 24,567,200 bbl. condensate. †Week ended previous Monday. ‡Alaska and South Dakota.

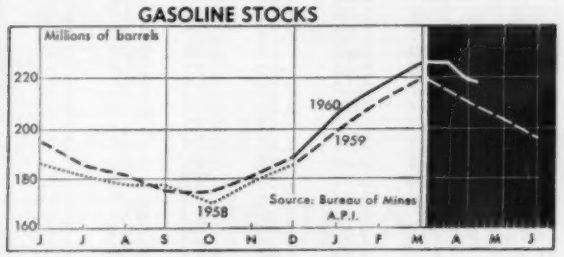
CRUDE-OIL PRODUCTION

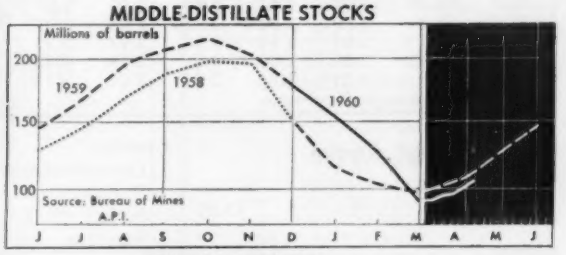


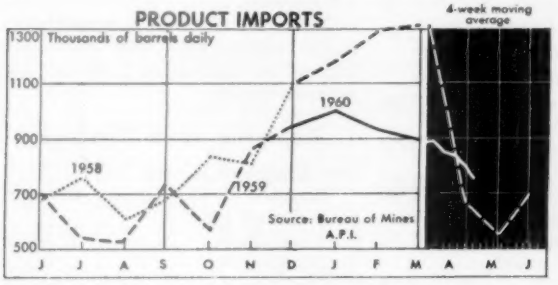


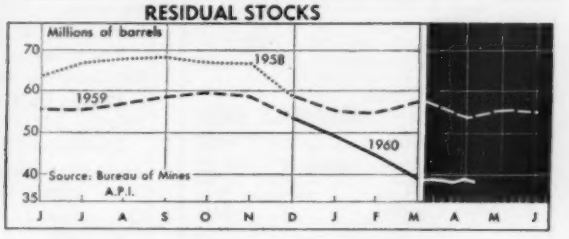












API REFINERY REPORT—MAY 6, 1960

(Thousands of barrels)

District—	Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.	Stocks‡ Gaso.†	Kero.	Dist.	Resid.	Bureau of Mines, May 1959 Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.
East Coast	1,022	424.0	40.6	259.6	131.1	46,145	8,187	26,891	9,955	1,014	437.8	19.7	300.4	144.5
Appalachian:														
District 1	94	37.7	3.0	23.1	10.6	6,102	498	1,940	417	89	40.0	3.2	17.4	9.9
District 2	98	52.9	1.9	21.7	11.9	3,057	270	886	379	87	50.2	5.7	15.6	10.5
Ind., Ill., Ky.	1,482	708.3	65.8	273.0	152.6	41,751	4,149	14,291	4,159	1,437	743.8	60.9	272.7	156.8
Minn., Wis., Dak.	85	42.7	4.1	22.1	13.4	6,675	704	2,848	580	103	48.4	4.5	23.7	13.1
Okla., Kans., Mo.	704	378.1	14.1	140.0	14.6	21,568	1,012	6,979	894	713	396.1	8.7	169.4	18.6
Inland Texas	272	201.1	11.7	48.3	20.4	7,563	529	1,515	2,440	283	204.1	8.2	49.7	20.3
Tex. Gulf Coast	1,947	1,010.0	81.4	466.8	115.0	26,732	2,446	9,207	4,591	1,991	994.0	77.6	478.2	167.6
La. Gulf Coast	547	256.6	25.6	137.1	42.6	13,056	1,416	3,100	954	696	367.3	45.2	157.2	48.9
N. La. and Ark.	103	56.3	5.9	22.1	5.3	6,055	561	2,165	127	103	48.3	4.0	23.5	6.7
Rocky Mtn.:														
New Mexico	19	12.0	0.4	3.0	1.4	883	46	170	120	17	10.8	...	3.4	2.4
Other	211	100.9	2.6	53.6	29.4	7,317	234	2,307	946	244	112.6	2.5	52.9	31.5
West Coast	1,204	565.7	30.0	191.9	265.6	31,868	1,416	11,202	13,143	1,119	507.4	4.3	187.5	268.4
May 6, 1960	7,788	3,846.3	287.1	1,662.3	813.9	218,772	21,468	83,501	38,705	7,896	3,960.8	244.5	1,751.6	899.2
Apr. 29, 1960	7,945	3,929.7	321.1	1,716.0	946.0	219,524	20,024	18,373	39,320	.....	.....	.....	.....	.....
May 8, 1959	7,722	3,857.6	251.2	1,713.6	931.0	208,409	21,616	87,655	55,553	.....	.....	.....	.....	.....

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipelines.

Crude-Oil Prices

GRAVITY SCHEDULE

	Signal Hill, Calif.	Oklahoma	West Tex. (sour)	West Tex. (Inter.)	No.* Texas	Texas Refugio Light	Bayou Sale (La.)	Denver Julesburg	Wyo. (sour)
14-14.9	$1.76	....	....	....	....	....	....	....	....
15-15.9	1.84	....	....	....	....	....	....	....	$1.81
16-16.9	1.92	....	....	....	....	....	....	....	1.86
17-17.9	2.00	....	....	....	....	....	....	....	1.91
18-18.9	2.08	....	....	....	....	....	....	....	1.96
19-19.9	2.16	....	....	....	....	....	....	....	2.01
20-20.9	2.24	$2.49	$2.35	$2.61	$2.29	$2.95	$2.90	$2.58	2.06
21-21.9	2.32	2.52	2.38	2.63	2.33	2.97	2.92	2.60	2.11
22-22.9	2.39	2.55	2.41	2.65	2.37	2.99	2.94	2.62	2.16
23-23.9	2.46	2.58	2.44	2.67	2.41	3.01	2.96	2.64	2.21
24-24.9	2.53	2.61	2.47	2.69	2.45	3.03	2.98	2.66	2.26
25-25.9	2.60	2.64	2.50	2.71	2.49	3.05	3.00	2.68	2.31
26-26.9	2.67	2.67	2.53	2.73	2.53	3.07	3.02	2.70	2.36
27-27.9	2.74	2.70	2.56	2.75	2.57	3.09	3.04	2.72	2.49
28-28.9	2.81	2.73	2.59	2.77	2.61	3.11	3.06	2.74	2.54
29-29.9	2.87	2.76	2.62	2.79	2.65	3.13	3.08	2.76	2.59
30-30.9	2.93	2.79	2.65	2.81	2.69	3.15	3.10	2.78	2.63
31-31.9	3.00	2.82	2.68	2.83	2.73	3.17	3.12	2.80	2.67
32-32.9	3.06	2.85	2.71	2.85	2.77	3.19	3.14	2.82	2.71
33-33.9	3.12	2.88	2.74	2.87	2.81	3.21	3.16	2.84	2.75
34-34.9	3.17	2.91	2.77	2.89	2.85	3.23	3.18	2.86	2.79
35-35.9	3.22	2.94	2.80	2.91	2.89	3.25	3.20	2.88	2.83
36-36.9	3.27	2.97	2.83	2.93	2.93	3.27	3.22	2.90	2.87
37-37.9	3.31	2.99	2.86	2.95	2.95	3.29	3.24	2.92	2.89
38-38.9	....	3.01	2.89	2.97	2.97	3.31	3.26	2.94	2.91
39-39.9	....	3.03	2.92	2.99	2.99	3.33	3.28	2.96	2.93
40-44.9	....	3.05	2.95	3.01	3.01	3.35	3.30	2.98	2.95

*Cooke, Grayson, Montague.

Flat Prices

Louisiana:
- Sweet Lake $3.00

Texas:
- East Texas 3.05-3.25
- Conroe 3.23-3.53
- Van 3.08

Pennsylvania Grade:
- Bradford $4.70
- Middle District 4.52
- Southwest Pennsylvania ... 4.25
- West Virginia 4.07
- Buckeye Grade 4.07

Illinois Basin **3.00**

Foreign

Middle East, Persian Gulf (cargoes f.o.b. lifting port):
- Arabian, about 34°, Ras Tanura $1.90
- Iranian, 34.0°-34.9°, Bandar Masur 1.86
- Iranian, 34.0°-34.9°, Abadan 1.81
- Iraq, 36.0°-36.9°, Fao 1.82
- Kuwait, 31.0-31.9°, Mina-al-Ahmadi 1.67
- Qatar, about 41°, Um Said . 2.05

Middle East, E. Mediterranean:
- Arabian, about 35°, Sidon . 2.29
- Iraq, about 35°, Tripoli, Banias 2.29

Far East (cargoes, f.o.b. Lutong, Sarawak):
- Seria Light, 37° 2.57

Canada:
- Leduc-Woodbend $2.53
- Redwater (Alta.) 2.42
- Smiley (Sask.) 2.18
- Pembina 2.38

Venezuela:
- Cumarebo, 47°-47.9°, Tucupido 3.34
- San Joaquin, 40°-40.9°, Puerto La Cruz 3.08
- Oficina, 35°-35.9°, Puerto La Cruz 2.80
- Tia Juana medium, 26°-26.9°, Amuay* 2.30
- Quiriquire, 16.0°-16.4°, Caripito 2.10
- Lagunillas heavy, flat, Las Piedras* 2.10
- Bachaquero, flat, 15°-16°, Las Piedras* 1.88

Prices for all crudes of 24° or lighter vary 2 cents per degree change, up or down. All crudes heavier than 24° vary 2.5 cents per half-degree gravity change.

*Also available at La Salina at 3 cents per barrel less.

Tanker Rates (Long Ton)

(Latest reported spot fixtures)

- ★ Gulf-NY, clean (ATRS −15%) $2.42
- ★ Gulf-NY, dirty (ATRS −32.5%) 1.92
- ★ Carib.-NY, dirty (ATRS −63.75%) 1.00
- ★ PG-UK, dirty (Scale −67.5%) (21s. 10d) 3.05

★ Denotes change from previous week.

Refined-Product Prices

Following quotations are realistic spot prices for refined products moving interstate on Wednesday each week. They may differ from refiners' posted prices and should not be considered as postings.

Light-product prices are in cents per gallon. Residual and crude prices are dollars per barrel. Crude prices are at the well unless otherwise listed.

Gasoline*

Mid-Continent (Group 3):
- ★ Regular (91 octane) .. 10.50-10.75
- ★ Premium (99 octane) .. 13.00-13.50
- Natural gasoline (26-70) 4.5
- Breckenridge 4.0

Gulf Coast (cargoes for coastwise or export movements):
- Regular (90 octane) .. 10.00-10.25
- Regular (92 octane) .. 10.25-10.50
- Premium (98 octane) .. 11.00-11.50

California (rack) Los Angeles):
- Regular (88 octane) .. 11.65-12.15
- Premium (94 octane) 12.65-13.15
- Premium (100 octane) 14.00-14.65

Caribbean area (cargoes):
- Regular (87 octane) .. 10.00
- Premium (97 octane) 11.625

*Quotations are for octanes shown. Prices usually vary with octane ratings within the regular, premium, and aviation grades.

Kerosine and Distillate

Mid-Continent (Group 3):
- Kerosine 42-44 ..... 9.00-9.50
- Diesel oil (58 d.i. and above) 8.75-9.25
- Distillate No. 1 ..... 8.75-9.25
- Distillate No. 2 ..... 7.75-8.25

Gulf Coast (cargoes):
- Kerosine 41-43 ..... 8.625-9.00
- Distillate No. 2 .... 7.625-8.00

New York Harbor (barges):
- Kerosine 41-43 ..... 9.8-10.3
- Distillate No. 2 ..... 8.8- 9.3
- Diesel fuel, 48-52 d.i. .. 9.1- 9.6

Caribbean area (cargoes):
- Distillate No. 2 ..... 8.00

Residual Fuel (Bbl.)

Mid-Continent (Group 3):
- Residual fuel (max. 1% S) $1.70-1.80

Gulf Coast (cargoes):
- Bunker C fuel 2.10-2.25

New York Harbor (barges):
- Bunker C fuel $2.47

Caribbean (cargoes):
- Bunker C $2.10

California (rack):
- Bunker C fuel, Los Angeles $2.15

★ Denotes change from previous week.

CLASSIFIED ADVERTISING

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RATES:
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FOR SALE EQUIPMENT

FOR SALE: New steel mud tanks with V-bottom and pump for jets; sliding doors for mud leveling with expanded metal folding walkways, has 4½" drillpipe for jet lines on top of both sides. Overall dimensions 6' high x 7'6" wide x 30' long. Call, write or wire: Central Tool & Supply Company—MAin 4-6651, Liberal, Kansas or CEntral 2-6318, Oklahoma City, Oklahoma.

1500 FAILING long mast, kelly, diesel powered. KC Franks complete. Box L-841, The Oil and Gas Journal, Tulsa, Oklahoma.

LARGE QUANTITY overstocked new Darling pipe line valves selling at 50% off list, also selling large quantity of other valves at greatly reduced prices. Your inquiry will be appreciated, Industrial Supply Company, Wichita Falls, Texas.

BAILEY BRIDGES
Portable Prefabricated
BAILEY BRIDGE
RENTALS & EQUIPMENT
P. O. Box 753,
San Luis Obispo, Calif.

NEW CROLOY 5 HEATER TUBES

14—3¾"	x ⅜"	wall x 44' long
63—4"	x ⅜"	wall x 26' long
10—4"	x ⅜"	wall x 32' long
50—4"	x ½"	wall x 32' long
3—5"	x ½"	wall x 42' long
42—6"	x ½"	wall x 27' to 47' long

HEAT & POWER CO., INC.
60 E. 42nd St., N. Y. 17, N. Y.

—PIPE—

2,000,000 ft.	2"	3.50# to the ft.
1,000,000 ft.	3"	7.70#
1,000,000 ft.	4"	10.98#
500,000 ft.	6"	19.80#
200,000 ft.	8 5/6"	28#
400,000 ft.	10¾"	35#
75,000 ft.	12¾"	40#
10,000 ft.	16"	42#

All No. I Grade plain end and cleaned.
INDIANA-OHIO PIPE CO.
P. O. Box 5412 Shep. Sta.
Columbus 19, Ohio
Phone CL 3-5527

FOR SALE
10,000 ft. 14" O.D. Used Lapweld Pipe .281 Wall—41.21 # per ft. Plain end—machine cleaned #1 and Good #2 grade
Single Random Length
Wire, Write, or Phone
COLUMBUS STEEL SUPPLY
1000 BONHAM AVE. • AX 4-4461
COLUMBUS, OHIO

FOR SALE EQUIPMENT

FOR SALE OR LEASE: Three (3) large perforating trucks complete with 16,000' of 7/16" single conductor line. These units are ready for the field. Box L-614, The Oil and Gas Journal, Tulsa, Oklahoma.

WELL DRILLS—CORE DRILLS. Everything for well and core drilling in both new and used equipment at money saving prices. Fishing tools rented. Send for bulletins. Pressey & Son, Pueblo, Colo.

USED PRI MODEL 111-C portable scintillator crystal dia. 2¼" wt. 8½ lbs. or other similar. P. O. Box 5315, Tulsa, Okla. Tel. RI 2-8271.

FOR SALE
WILSON-TITAN
The following equipment was in first class working order before we broke up the rig.
DRAW WORKS
(No motors. Formally had three LRO Waukesha motors)
COMPOUND
GEAR-BOX ASSEMBLY
PARKERSBURG BRAKE
(Newest model)
IDECO
27-in. Rotary Table
ROCKTON DRILLING CORP.
14 Wood St., Pittsburgh 22, Pa.
Phone GRant 1-3200

LIQUIDATION
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BOILERS, 70,000 #/hr. & 80,000 #/hr. 450 Psi.
HORTONSPHERES, 5,000 & 10,000 bbl.
EXCHANGERS, 78 to 2,800 sq. ft.
TOWERS, 3 ft. to 7½ ft. diameter.
VESSELS, 2 ft. to 10 ft. diameter.
FURNACES, 26 MM BTU/hr.
TURBO EXHAUSTERS, 15,360 & 17,000 CFM.
CENT. PUMPS, 15 to 7,800 GPM.
TURBINES, 5 to 290 HP.
TANKS, 1,000 to 29,000 bbl.
COMPRESSORS, (1R) XVG—4 & XVG—2.

BRILL EQUIPMENT COMPANY
DESTREHAN, LA.
TEL. NORCO 6571
35-53 JABEZ ST. NEWARK, N. J.
4101 SAN JACINTO, HOUSTON, TEXAS

FOR SALE EQUIPMENT

DOUBLE DRUM Spudder on IHC truck. Cooper E 563-42-36 complete. New lines. Box 736, Great Bend, Kansas. GLadstone 3-8817.

NATIONAL IDEAL MUD PUMP—Model C-150-B 7¼" x 12", 12 sheaves, skid mounted with LeRoi 8D-2000 engine. Ready to work. In yard at Carrizo Springs, Texas. TRAVIS DRILLERS, Inc., P. O. Box 1097, Austin, Texas. Phone GR 2-3422.

LIQUIDATION
at ESSO REFINERY Balto., Md.

10,000 BBL/DAY FLUID COKER COMPLETE—NEW 1955 STILL ON FOUNDATIONS

TOWERS

10' x 145'—	125 PSI 50 trays
9'6" x 121'—	325 PSI 30 trays
8'6" x 103'—	165 PSI 24 trays
7'0" x 82'—	75 PSI 30 trays
6'0" x 80'—	300 PSI 30 trays
4'0" x 44'—	150 PSI 12 trays
3'6" x 36'—	400 PSI 12 trays
2'6" x 52'—	360 PSI 22 trays
2'2" x 37'—	85 PSI 4 trays

HEAT EXCHANGERS—CONDENSERS

Steel Tube	7,500 to 100 sq. ft.
Adm. Tube	3,500 to 236 sq. ft.
Cu Ni Tube	2,330 to 308 sq. ft.
S. S. Tube	1,000 to 170 sq. ft.

CLARK COMPRESSORS
RA5 GAS ENGINE 2VTH 17" x 14" CYL

BLOWERS—28,000 CFM @ 17 PSIG
11,880 CFM @ 11 PSIG
INSTRUMENTS—Controllers, Recorders, Indicating and Transmitting
MOTORS—10 HP to 500 HP XP
PIPE CHROME—3¾" to 14" OD
PUMPS—Hot Oil, Steam, Centrifugal
REACTOR—9' x 32'6" OA
REBOILERS—2,700 to 450 sq. ft.
TRANSFORMERS—5 KVA to 333 KVA
VALVES—Diaphragm, Butterfly Slide and Pressure Regulating
VESSELS PRESSURE—3' to 12' Dia.

PETRO CHEM FURNACE
1.9 MILLION BTU NEW 1949

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310 Thompson Bldg., Tulsa 3, Okla.
Box 5203, Baltimore 24, Maryland

FOR SALE EQUIPMENT

18" AND 20" good used pipe. Very attractive prices. Contact: The Tri-State Pipe Co., Bellaire, Ohio. Telephone OR 6-1452.

A LIMITED quantity Westinghouse 10 HP, 1150 RPM, 3-Phase, 60 cycle, 220/440 volt, high starting torque, totally enclosed fan cooled oil well pumping motors reconditioned in our shop, $195.00 each 1 to 4 motors, $175.00 each 5 to 10, $155.00 10 or more, FOB San Antonio, Texas, Loyd Electric Co. Inc., Phone CA 7-1309.

1—128CH EMSCO used pumping unit 461,000# peak torque complete with M-34 Fairbanks engine, unit and engine in excellent condition, Price $3,800.00. 1—8' x 28' B.S. & B., used, Type F Heater complete with all fittings, Price $1,800.00. Above equipment located in Oklahoma, if interested, contact: Rex Petroleum and Equipment Company, Tulsa, Oklahoma. Phone LUther 4-6339 or LUther 5-8551.

PARKERSBURG PUMPING unit SC-10 stroke from 48" to 120". Polish rod load 20,000#. Bellaire Pipe & Supply Co., 8020 Lyons Ave., OR 4-2763, Houston 29, Texas.

FOR SALE—One (1) 13⅜" L.R.—No. 51-3 Landis Receding Chaser Pipe threading and cutting off machine complete with standard auxiliary equipment, No. 13⅜" receding No. 50-2 diehead-API taper thread for pipe 8⅛" to 13⅜"—15 HP motor drive. Originally purchased in 1943, total operating time 3½ years, replacement cost is $20,000.00 Complete details upon request. Submit offers to K. M. Miller, Rohm & Haas Company, 222 Washington Square, Philadelphia 5, Pa.

FOR SALE: Four Diesel Powered Rotaries complete, Special Built 2,500 ft., 2000 Mayhew, 1500 Failing Special, 1500 Winter Weiss Special, Also, Spudders, 83 Special Tandem, 72 Full Trailer, 71 Truck mounted Speedstars, and #10 Ideco. Star Drilling Supply Co., Chanute, Kansas.

ONE TWIN ENGINE D18S Beechcraft Airplane, 1946 model, Serial No. A285, CAA License N80385, TT 6060 Hours Airframe, 888 Hours each engine SMOH, 5 Reclining Chairs, Radio equipped, De-Icing Equipment, Licensed to 8-14-60. Inspection by appointment, Love Field, Dallas, Texas. For further information contact The Atlantic Refining Co., Purchasing Dept., P. O. Box 2819, Dallas, Texas.

1 BUCYRUS—ERIE 36L Spudder, late model. Rig complete with tools and equipment. Cassel Drilling Co., Inc., Dumas, Texas. Phone WE 5-5019 or WE 5-4369.

EQUIPMENT WANTED

Two mobile 3,500 ft. drilling rigs Complete with drill pipe, collars, tools etc. State condition; price; full particulars.

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2300 Gibson Road, Bakersfield, California
Phone FAirview 7-3857

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NEW OIL JOB Directory, foreign and domestic, showing where to apply for jobs. 500 selected producing, refining, butane and pipeline companies. Nationwide, $5.00 cash. List Aircraft mechanics' schools—$3.00. OIML Co., Box 2603, Tulsa, Oklahoma.

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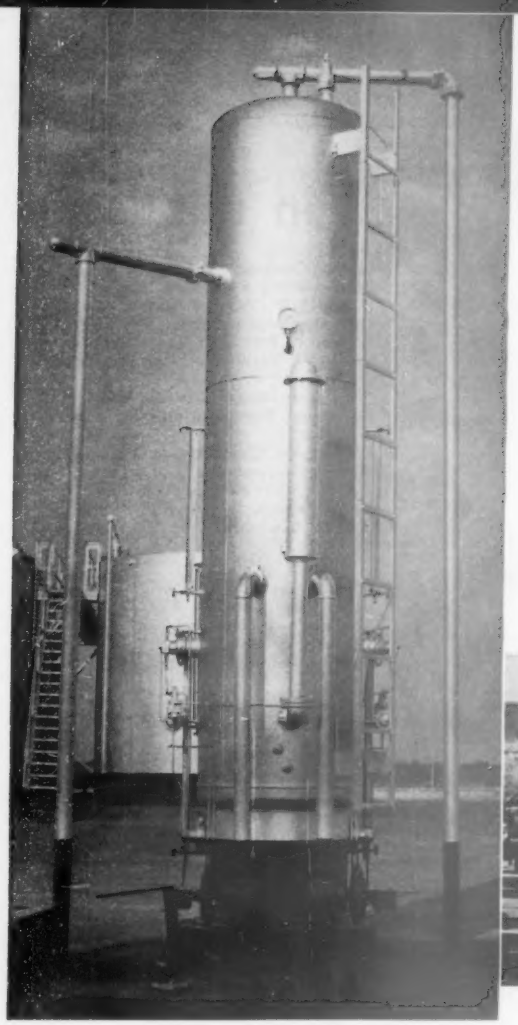

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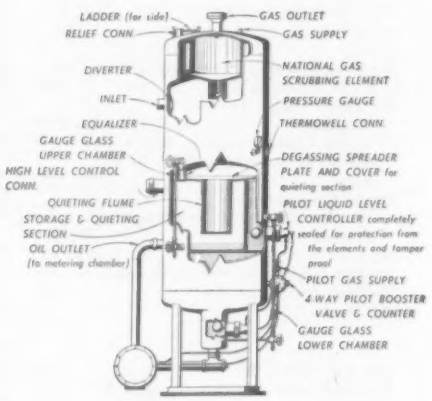

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